JPRS-WST-85-019

24 June 1985

West Europe Report

SCIENCE AND TECHNOLOGY

FBIS FOREIGN BROADCAST INFORMATION SERVICE

NOTE

JPRS publications contain information primarily from foreign newspapers, periodicals and books, but also from news agency transmissions and broadcasts. Materials from foreign-language sources are translated; those from English-language sources are transcribed or reprinted, with the original phrasing and other characteristics retained.

Headlines, editorial reports, and material enclosed in brackets [] are supplied by JPRS. Processing indicators such as [Text] or [Excerpt] in the first line of each item, or following the last line of a brief, indicate how the original information was processed. Where no processing indicator is given, the information was summarized or extracted.

Unfamiliar names rendered phonetically or transliterated are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear in the original but have been supplied as appropriate in context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by source.

The contents of this publication in no way represent the policies, views or attitudes of the U.S. Government.

PROCUREMENT OF PUBLICATIONS

JPRS publications may be ordered from the National Technical Information Service, Springfield, Virginia 22161. In ordering, it is recommended that the JPRS number, title, date and author, if applicable, of publication be cited.

Current JPRS publications are announced in Government Reports Announcements issued semi-monthly by the National Technical Information Service, and are listed in the Monthly Catalog of U.S. Government Publications issued by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Correspondence pertaining to matters other than procurement may be addressed to Joint Publications Research Service, 1000 North Glebe Road, Arlington, Virginia 22201.

JPRS-WST-85-019

24 June 1985

WEST EUROPE REPORT

SCIENCE AND TECHNOLOGY

CONTENTS

AEROSPACE

STEP-BY-STEP LAUNCH PREPARATIONS FOR ARIANE ROCKET, PAYLOAD

Paris L'AERONAUTIQUE ET L'ASTRONAUTIQUE in French No 110, 1985 Issue 3 pp 57-68

[Article by A. Mechkak and R. Lavaud, European Space Agency, Directorate of Space Transport Systems: "Firing the Ariane Launcher and Its Payload; Launch Preparation"]

[Text] The Ariane launcher and payload operations consist of the final integration of the elements of each of them, their assembly and check-out which precondition the authorization for launch. The object of this article is to describe the operations necessary for that preparation phase and to indicate in particular the importance of the check-out of the launcher.

General

During its existence, the launcher will go through several check-out stages, from that which consists in checking the conformity of the elementary parts of the various pieces of equipment that constitute the launcher to the monitoring of certain parameters that will make it possible to give clearance to the launch.

These checks progress according to the degree of integration of the equipment. In Europe, on operational-flight launchers, the most advanced level consists in checking that the electric and pneumatic systems of the subassemblies (propulsion stages, instrument pack, nosecone) are in perfect mechanical condition and are working properly. These operations take place at the respective integration sites of the various elements, using simulators that reproduce the fluid and electric interface of each subassembly.

Once these checks have been made, the "stages" are ready to be shipped to the launching center to be assembled into a complete launcher.

Because damage could occur during shipment and during stage assembly, additional checks must be made.

Also, although the compatibility of the various launcher parts has already been demonstrated during previous exercises (electric model, mechanical model, previous launches), it was deemed necessary to carry out again systematically a number of checks, considering the extreme degree of precision required of the launcher performance and, in addition, it is also necessary to check that the links between the launcher and the ground facilities (radar stations, telemetry, safeguard remote-control) are operating correctly.

Brief Description of the Launcher

The launcher consists essentially of three propulsion stages which include pneumatic and hydraulic systems (including propellant circuits), electric and pyrotechnic lines, an instrument pack, the real brain of the launcher, a nosecone designed to protect the satellite, and two booster propulsion units attached to the first stage.

The first stage includes two separate and identical tanks of about 70 m^3 each, one of which contains N_2O_4 and the other UH_{25} (approximately 145 tons of propellant), the propulsion bay consisting of a frame on which are fixed the four engines and the various circuits of the propellant and fluid system. The rear, intertank and forward skirts are equipped with the electric and pyrotechnic systems. The tanks are pressurized with flight-pressure nitrogen prior to the launch and, during the flight, by hot gases taken from a generator that also supplies the motor turbopumps.

The second stage, which uses the same propellant agents as the first, includes only one motor and also two tanks sharing one bottom. The total mass of propellant agents loaded on board is approximately 34 tons, and the tanks are pressurized during flight by helium stored in spheres located on top of the forward bottom of the stage. The skirts contain the electric and pyrotechnic systems of the stage.

The third stage, with a single motor, uses liquid oxygen and hydrogen (approximately 10 tons in all) and consists of two tanks with a common bottom. Pressurization during flight is provided by helium stored in a sphere for the LOX [liquid oxygen] tank, and by hydrogen gas collected at the inlet of the combustion chamber for the hydrogen tank.

The instrument pack contains most of the electric equipment of the launcher. For the "guiding-piloting" chain, there is in particular the flight computer, the inertial unit and the automatic pilot. The "sequential" chain includes essentially the command unit which transmit the commands worked out by the computer and in transit through the interface unit.

As for the safeguard functions, a safeguard box transmits to the launcher the commands sent from the ground and received on board by remote-control receivers. Localization is provided by two radar transponders.

The nosecone consists of two parts that are bolted together; it is attached to the instrument pack by a strap tightened to about 11 tons. The opening and release of the nosecone during flight, which are triggered when a given kinetic-flow threshold is detected, are achieved by pyrotechnic systems.

The booster propulsion units, each of which contains 7.35 tons of powder propellant, are made integral with the first stage through a system (DASL [expansion unknown]) that makes it possible to release them when the combustion of the powder is completed, i.e. about 40 seconds after the launcher takes off.

Assembly Operations

We observe essentially two distinct stages separated by an important event: the meeting of the payload and the launcher.

This meeting usually takes place 6 to 7 days before the launch, and it is at that time that the campaign enters the stage covered by the Combined Operations Plan (POC).

Assembly of the Propulsion Stages and the Instrument Pack

Before clearance is given to start the assembly operations, a technical analysis takes place to draw up an exhaustive picture of the situation, giving in particular a list of the remarkable points of the campaign (non-standard operations scheduled on the launcher and the launching base, equipment peculiarities, etc.).

Then, the first stage (L140) is removed from its container and taken to the foot of the tower of the Ariane launch site (ELA) where it is erected and attached to the launching table. Connections with the ground are then made and the forward bottom (FAV), the intertank skirts and the interstage skirt are inspected. Meanwhile, the second stage (L33) is taken out of storage and brought on location to be erected and placed on the interstage skirt which has itself been attached to the L140 after its inspection.

By then, the launching campaign has reached day J-20 or so, and third-stage assembly operations may start, to be followed immediately by the instrument pack assembly.

The first stage of the mechanical assembly of the launcher is then completed, and pneumatic and electric check-outs are going to take place simultaneously before the beginning of the second assembly stage that will yield the final launching configuration.

Type-III Check-Outs

They are very numerous and are designed to make sure that the performance level obtained in Europe, during testing of the stages, did not vary as a result of shipment or due to an excessive drift of equipment characteristics.

The quality and accuracy of the parameters to be evaluated require a lot of high-performance equipment consisting essentially in the various bays of the launching center (CDL) located on the Ariane launch site of the Guiana Space Center (CSG).

The various specialized bays are piloted by two computers, one of which will check the electric systems (K1), while the other checks the fluid and propellant systems (K2).

However, many operations can be carried out with manual controls, from specialized consoles.

Mechanical, Hydraulic and Pneumatic Check-Outs

These checks have essentially three objectives:

- Visual inspections intended to check equipment appearance (lack of mechanical damage), to make sure that all pneumatic and electric connections are made and that the various connectors are properly locked and safetied.

- Tightness of the pneumatic systems (tank pressurization, valve controls) and of the hydraulic systems (servojacks). Pneumatic tightness is checked either with helium or under dry-nitrogen pressure. As a rule, the checks are done at service pressure, so that they are divided into two stages: a first stage including all low-pressure tests, and a second stage for the high-pressure containers of the launchers (GOC [expansion unknown], Pogo, second-stage He spheres, etc.). Note, however, that due to their "ground stand-off" configuration certain systems of the integrated launcher cannot be checked at their service pressure and are therefore tested only at a much lower pressure (usually 6 bar).

In that case, it is the guarantee that each of the components of the system has been manufactured to perfection and subjected to exhaustive individual checking, and that the procedures validated during previous tests and flights have been followed that makes it possible to be satisfied with a check-out that does not cover the whole field of operation.

Hydraulic-tightness checks are made either through visual inspections of the elements (cylinder rods, system connections), or by parameter readings obtained by telemetry (hydraulic capacity pressures) during dynamic tests.

- Operation of pneumatic organs (valves, pressure-reducing valves, regulators, etc.) or hydraulic organs (servojacks). Coupled with electric checks, their goal is essentially to make sure that shipment and assembly have not altered the operation of the various pieces of equipment involved and that no crippling drift has occurred since the last performance check-outs made in Europe. For valves, a check-out of "on/off" test reports is made and for some of them the response times are compared with the references adopted and with the values observed at the time of acceptance of the stages in Europe, and the sliding-pressure differentials of regulator pistons are measured. Check-outs on servojacks consist in particular in checking the times required for high-pressure capacity restitution, and the functions of transfer of turning orders received from the automatic pilot.

Check-Outs of the Electric Chains

The architecture of the electric systems of the launcher is organized around three functional chains (piloting-guiding, sequential, safeguard) and one measurement-telemetry chain. Each is subjected to specific checks, but we should note that the functional chains are relying on the telemetry chain for the acquisition of parameters that will make it possible to assess their condition or operation. This chain, therefore, must be validated before any other functional electric check-out is made (except for insulations and continuities, of course, which are done before all other checks).

- Measurement-Telemetry Chain

This check-out consists in checking wire connections. Essentially, it is designed to make sure that a number of sensors used for operations and for the release sequence are in good operating condition. These systems are connected to certain specialized bays on the ground, which are adapting the signals received from the launcher in order to make them compatible with the processing organs (computers) of the launching center.

As far as telemetry systems are concerned, check-outs are made to make sure that emitters and antennas are operating correctly (emitted and reflected powers, standing-wave ratios, bit-error rates), and the behavior of the various acquisition units as well as the operation of the sensors are checked.

- "Sequential" Chain

This chain forwards the commands sequentially emitted by the flight computer toward the organs of execution. Its check-out consists, on the one hand, in checking the routing and execution of the commands and also in making sure that performance figures are maintained (execution time). Since its circuits are redundant, the check-outs also involve making sure that commands can be transmitted indifferently through any of these paths.

On certain circuits intended to fire pyrotechnic elements (stage, nosecone or payload separation, braking or accelerating rockets, third-stage firing or powder-propellant propulsion units), indicator initiators are connected to the circuit ends in order to check that the command is carried out.

- Localization-Safeguard Chain

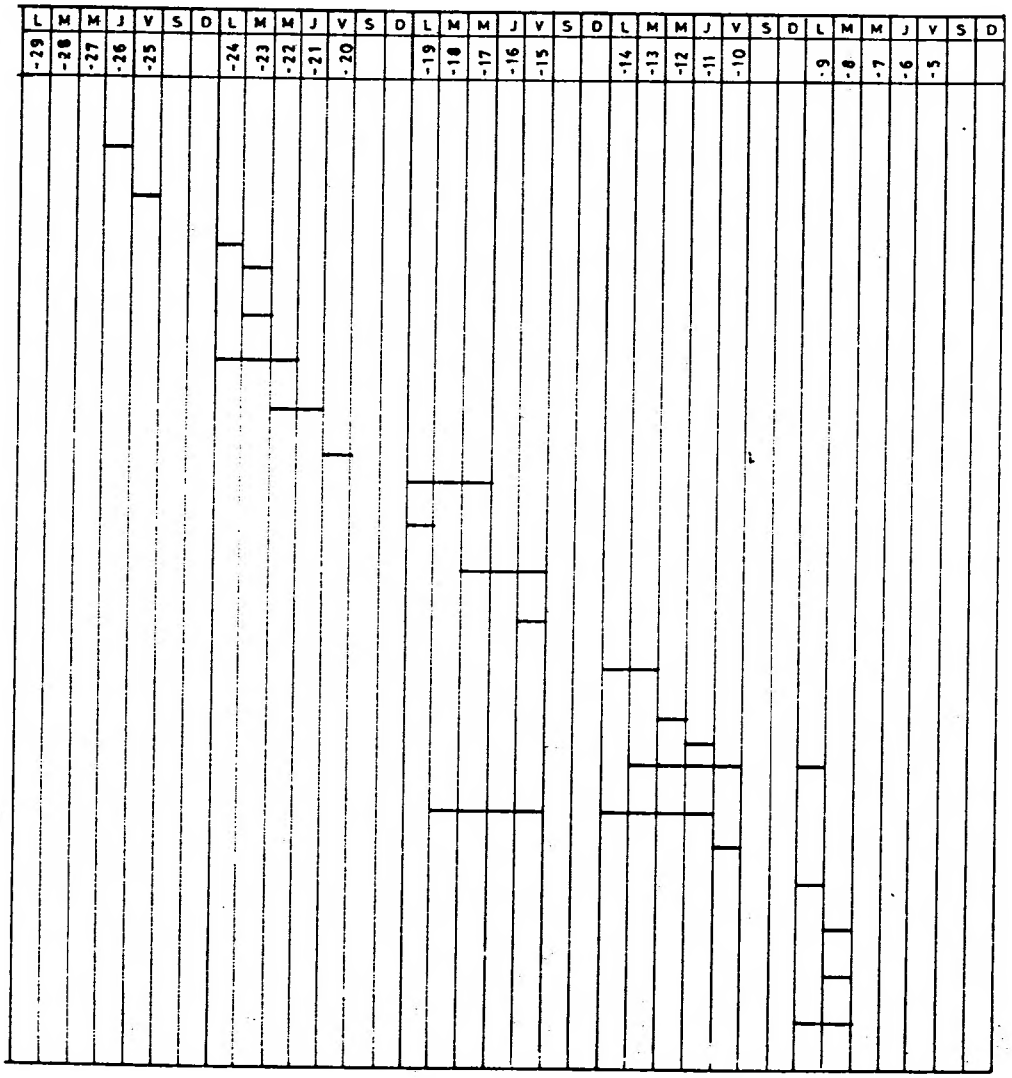
Localization is ensured by two radar transponders operating in redundance, and the check-outs consist in ascertaining the power consumption as a function of the number of radars that query them.

The programmed destruction of the launcher can take place in three cases:

a) In case of a dangerous path, a destroy order is sent from the ground, decoded on board in the remote-control receiver (RTC) and sent to the various execution boxes of the stages (DCA) via the safeguard box (BS) which is located in the equipment pack. During check-outs at the Guiana

Standard Campaign Operations

Day:



- First stage taken out of storage
- First stage erected
- Second stage erected
  Mechanical and electric connections
- Nosecone taken out of storage, erected, put in CTC
- SYLDA taken out of storage, prepared at S3
- Prep. 1st & 2nd stage prop. assemblies
- Third stage erected
  Pneumatic connections
- Instrument pack placed on third stage
- Tightness of the three stages
- First long calib. of instrument pack
- Cleaning of third stage
- First & second-stage GOC, SCP checks
- Second and third stage preparation
- First stage preparation
- Type-III electric checks
  Dynamic piloting
  Overall check-out
- Integration of first flight PA
- Testing of third-stage sphere
- Start of Combined Operations Plan at S3

Table 1. Standard Campaign Operations

Key: L: Monday; M: Tuesday; M: Wednesday; J: Thursday; V: Friday; S: Saturday; D: Sunday

Space Center, in addition to the execution of a command sent through a remote control box, the sensitivity of the remote-control receiver is also checked again.

b) When a propulsion stage separates itself untimely from the rest of the launcher, the DCA box of that stage immediately generates a destroy order. This function, which is initiated by straps being placed in open circuit as a result of the separation, is simulated during the tests by means of a bay (BCPS [expansion unknown]) plugged into the pyrotechnic interception outlets (PIP).

c) During a rated flight, when one stage has completed its mission and separates itself from the rest of the launcher, it is systematically destroyed 30 seconds later. This function is also checked by means of the BCPS.

All these tests are accompanied by the execution of the command, i.e. an indicator initiator is plugged into the outlets that are normally connected to the enabling boxes.

Overall Check-Out

Until rather late in the launching campaign (about day J-9), all check-outs involve either circuit elements or complete electric circuits or chains. After making sure that everything is in operating order, it is then possible to increase the level of complexity of the check-outs and to carry out an "overall check-out" that will involve all the electric chains of the launcher as well as a number of hydraulic and pneumatic systems. It consists in the following:

- Putting the electric chains in a configuration close to the one they will assume just prior to the launch, by going through a special preparation sequence (identical to,or differring only slightly from the synchronized sequence used in the chronological schedule).

- Putting the electric chains in an electric and electromagnetic environment very similar to the flight environment (radars, remote-control station, etc.).

- Having the flight computer execute a flight program that will stimulate the chains in a manner as similar as possible to mission conditions. Only a few commands are removed, because they are dangerous in view of the abnormal configuration of the launcher (lack of propulsion, lack of physical separation of the stages, etc.). All the chains are actuated, including the flight-control chain into which stimuli are injected to simulate the operation of accelerometers and gyros.

Rehearsal of the Launching Countdown

The object of this exercise is to check--before installing the payload and the nosecone--that the launcher is ready for the last operations that will give it its launch configuration. It consists in carrying out a full

sequence of the check-outs and operations that are part of the launching countdown, taking into account the fact that third-stage propellant tanks only are filled, which implies more severe constraints on the admissible wind value. Since the first and second-stage propellant tanks are empty, and since the various service-gas storage containers are under pressures lower than the flight pressure, the thresholds used to monitor check-out sensors are different from the rated thresholds.

This is also the occasion for an ultimate check-out of the cryogenic systems. Normally, this rehearsal takes place right before the launcher and its payload are brought together, when the implementation of the POC (Combined Operations Plan) begins.

2. Launching a Satellite--Launch Preparation

General

The operations leading to the launching of a satellite take place in two consecutive stages: the launch preparation and the launch itself. They are part of the "launching campaign" that starts when the satellite arrives at the launching base, the Guiana Space Center (CSG).

The satellite and associated equipment ready for shipment to the Guiana Space Center represent the materialization of a project that was usually divided into four stages:

- Preliminary studies and analyses, feasibility;
- Systems typing;
- Design and development;
- Production of the operational assemblies (hardware and software).

The satellite being integrated has been subjected to tests that can be classified in two types:

- Compatibility tests related to the environment created by the launcher and to the environment encountered in orbit (static and dynamic loads, temperatures, vacuum resistance, etc.). Depending on the safety coefficients applied, tests of this type lead to qualification or acceptance of the subsystems or systems that compose the satellite;

- Functional tests on the specific subsystems or systems of the mission (scientific experiments, telecommunications, etc.).

The integration and testing stage ends with the "Flight Aptitude Review" whose object it is to check that the satellite is technically capable of bearing the environmental constraints and fulfilling its mission.

The review also takes into account the condition of the associated equipment required for the launching operations. The flight aptitude review of the satellite is made before it is shipped to the Guiana Space Center.

When it arrives at the center, the satellite enters the launch-preparation stage. When this stage is completed, the satellite will constitute all or part of the launcher payload.

The payload of Ariane usually consists of one satellite (single launch) or two (double-launch) plus the adaptors required for the mechanical interfaces.

The length and complexity of the launching operations vary; they will obviously depend on the number and nature of the operations specific to each satellite and on the composition of the payload.

Brief Description of a Satellite

Satellites differ through their design or their functions. They can be classified into two major groups:

- Scientific satellites: each satellite is made only once, for a given mission.

- Application satellites: among these, are telecommunications satellites. They are often produced in small series corresponding to an operating program.

However, they do have certain points in common and, as an example, a model of realistic configuration can be given and described as follows:

The satellite consists of two main elements, a specific module representing the payload and a service platform.

- "Payload" Module

This module consists, for instance, of a group of scientific experiments and associated electronic equipment, or active telecommunications repeaters.

(Note: the payload defined as the specific part of a satellite should not be confused with the launcher payload).

- Service Platform

The platform fulfills the following major functions:

. system carrying the "payload";
. "payload" resources and services;
. interfaces with the launcher;
. interfaces with the earth segment.

Its main subsystems are the following:

. the structure supporting the equipment and providing interfaces with the launcher;
. the thermal control system which ensures that the satellite components remain within the specified temperature range; it can be active and/or passive;

- the attitude and orbit control system which stabilizes the satellite and makes it possible to carry out maneuvers in orbit by means of a jet-reaction system equipped with exhaust nozzles and using cold gases or liquid propellants decomposed by catalysis (hydrazine type);
- the data-processing system which provides for internal telemetry functions to transmit satellite data to the ground, and for remote-control functions to distribute within the satellite the orders received from the ground;
- telecommunications systems which provide links between the ground and the satellite by means of transponders and suitable antennas;
- the electric power supply which provides regulated energy from solar generators and batteries;
- the positioning booster motor that provides the impulse required to alter the transfer orbit achieved by the launcher. This motor can use solid or two-liquid propellants;
- pyrotechnic systems, which are used to trigger various mechanisms (to unfold solar panels, antennas, to open shutters, etc.).

This brief description of a satellite, listing basic subsystems, is important for the understanding of the operations that will have to be carried out on the launching base. In this respect, we should note that the following are present on board the satellite:

- thermal protection systems;
- pressurized gas and liquid-propellant tanks;
- a booster motor (solid of two-liquid propellants);
- pyrotechnic components.

Note that some of these components are classified as "hazardous." The first consequence of this is that, for safety reasons, they are not installed on the satellite, or are not included in the flight configuration during shipment to the Guiana Space Center. Other components, such as solar panels and batteries, must also be prepared and installed at the Guiana Space Center, as well as the thermal protection system, which must be completed by the end of the satellite integration.

Launching Operations at the Guiana Space Center--General

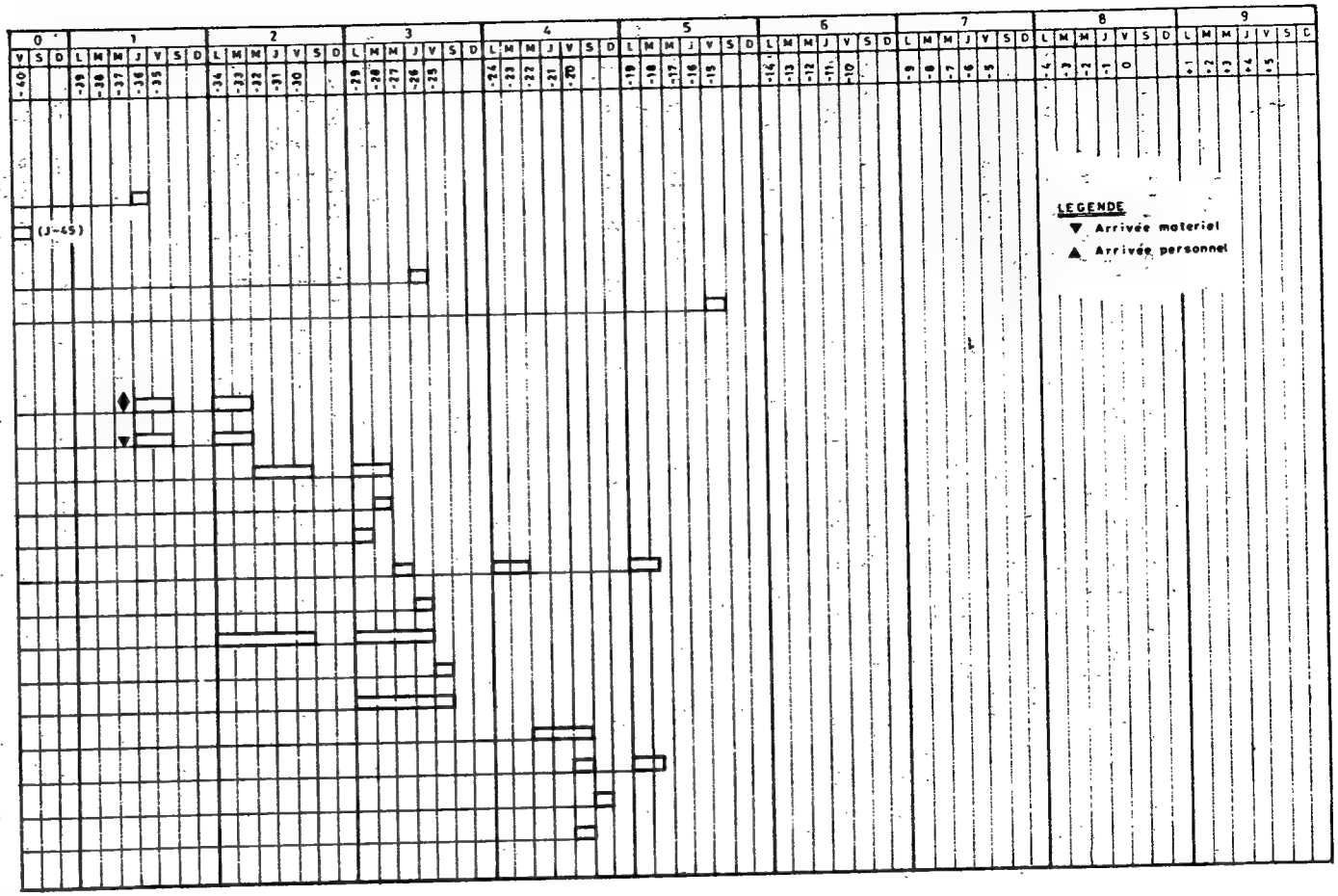
The satellite and its associated equipment are shipped by air to the Rochambeau airport of Cayenne, then by road from the airport to the Guiana Space Center. After shipment and handling, including packing and unpacking, transport, loading and unloading, then the distribution of the equipment to the various sites and finally the storage of hazardous components, the operations to be carried out to put the satellite in its launching configuration include three stages:

Stage 1: Satellite preparation and check-out
Stage 2: Operations classified as "hazardous"
Stage 3: Operations on the launch area.

To carry out these operations, the Guiana Space Center uses a series of means called "payload preparation unit" (EPCU). In addition to auxiliary mobile means, the payload preparation unit includes:

Operations

Day:



Site Preparation

Satellite prep. hall (S1)

Booster motor prep. hall (S2-S4)

Filling/assembly hall (S3)

Launching pad (ELA)

Satellite Preparation

EGSE/MGSE installation & validation

Satellite acceptance

Testing of integrated sat. (Part A)

Countdown rehearsal

Compat. w. ground syst. (telemetry)

Satellite preparation (thermal)

Pressurization/leak measurements

Packing batteries

Battery installation

Solar panel preparation

Solar panel installation

Inspection-shipping preparation

Testing ground systems (rem. cont.)

Launching aptitude review

Table A. Stage 1: scheduling of operations in building S1, scheduling of operations in building S2, scheduling of EPCU [payload preparation] sites.

Key: L: Monday; M: Tuesday; M: Wednesday; J: Thursday; V: Friday; S: Saturday; D: Sunday
▼ Arrival of equipment;
▲ Arrival of personnel.

- one building for the preparation of the satellite (S1);
- one building for the preparation of the booster motors (S2);
- one building where the satellite is assembled and filled (S3);
- one building for the radiography of solid-propellant booster motors (S4);
- storage buildings for the booster motors (PR3) and pyrotechnic components (PY3);
- one payload shipping container (CCU).

The Guiana Space Center also provides technical support on demand (chemical analyses, equipment repair, loan of measuring instruments, etc.) as well as a guard and surveillance service.

Stage 1--Satellite Preparation and Check-Out

Stage-1 operations are operations classified as "non-hazardous," which take place essentially in building S1.

Building S1 is located about 15 km from the launch area; it consists essentially in one "clean area" where the satellite and its mechanical ground-support equipment are installed, and premises containing the satellite check-out bays.

When preparation is completed, the satellite is placed in the payload container (CCU) and taken to building S3.

The check-out bays can remain operational and, therefore, are permanently connected to the satellite by a radio-link or by a radio-relay system and an umbilical link. The operations carried out in building S1 can be summarized as follows:

- inspection after shipment;
- operation of ground-support means (electric and mechanical means);
- preparation and assembly or installation of equipment on the satellite (batteries, solar panels, antennas, "Class-B" pyrotechnic components, etc.);
- partial-pressurization tests and checking for leaks;
- if needed, checking the alignment of optical or mechanical systems;
- checking functional systems or subsystems.

The schedule of operations in building S1 for a given satellite is given here as an example; it also includes the scheduled use of payload preparation sites placed at the user's disposal [Table A].

Stage 2--Hazardous Operations

The operations constituting stage 2 are classified as "hazardous" and take place in special buildings, S2, S3 and S4. Some of these operations can take place concurrently with stage-1 operations. The buildings in question are located in a protected area of the Ariane assembly area, near the launch area. Access to these buildings is subject to control, and the operations that take place there subject to the approval of the "Safeguard Department" of the Guiana Space Center.

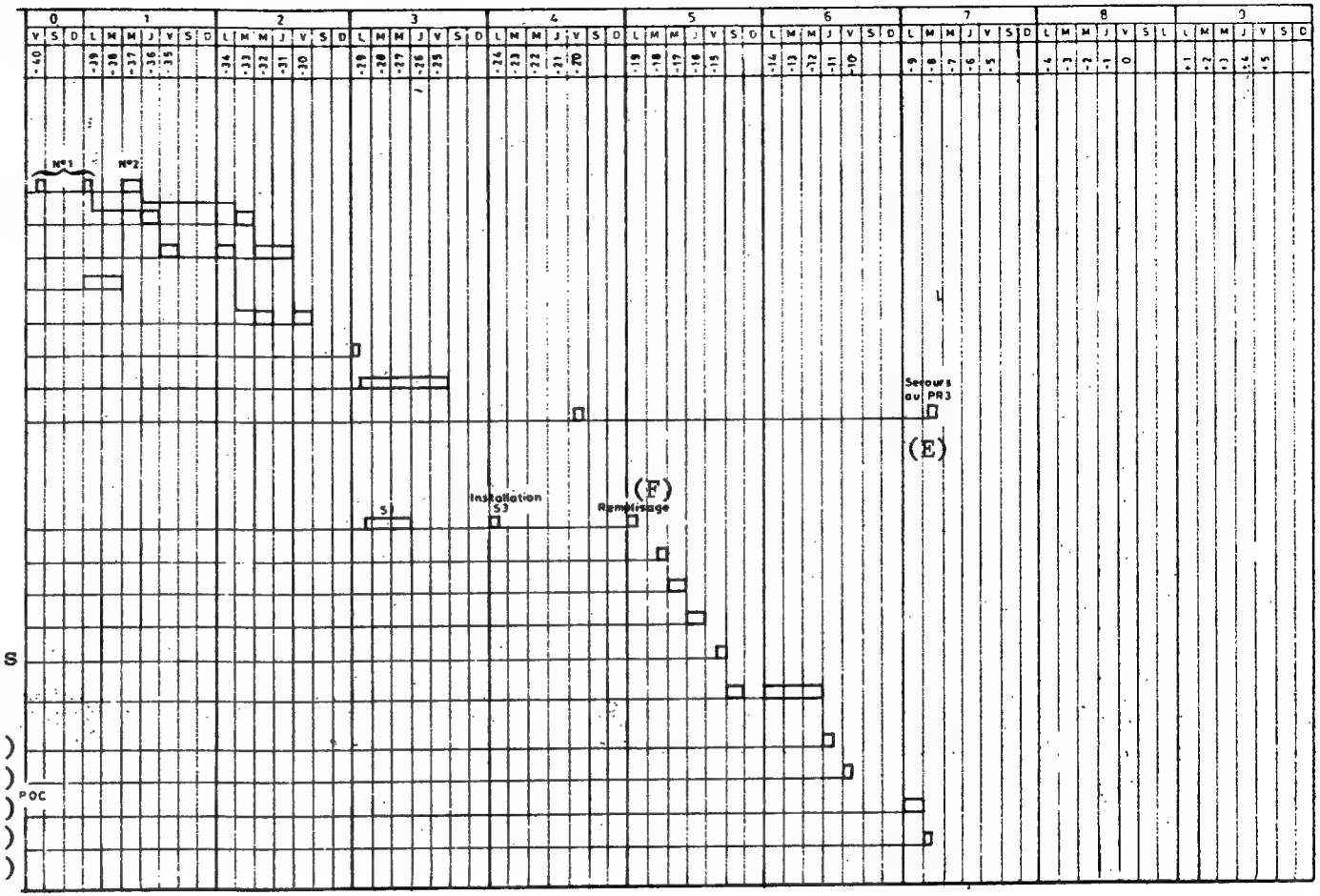


Table B. Stage 2: Schedule of operations

Key: L: Monday; M: Tuesday; M: Wednesday; J: Thursday; V: Friday; S: Saturday; D: Sunday
E: Emergency assistance at PR3
F: Filling

Building S2 is reserved for the preparation of the booster motors and to check out pyrotechnic components after they are taken out of storage and transported from buildings PR3 and PY3. During preparation, the booster motor is taken to building S4, which specializes in the radiography of "solid-propellant" type motors; it is then returned to building S2 where its preparation is completed.

Building S3 is specially designed to fill the tanks with liquid propellant agents and to pressurize them. The operations take place in a clean environment (Class 100,000). Two satellites can be processed at the same time and they can be assembled into a composite using a special adaptor: SYLDA (Ariane Double-Launch System).

When operations in this building are completed, the satellite(s) and flight adaptor(s) form the payload that will be placed in the payload container and taken to the launch area.

Stage-2 operations can be summarized as follows:

In building S2:

- preparation of the booster motor and of the pyrotechnic components.

In building S4:

- radiography of the booster motor.

In building S3:

- filling with propellant agents and pressurization;
- assembly of the booster motor and the satellite;
- dynamic balancing of the satellite;
- weighing of the satellite;
- final preparation--thermal protection;
- integration of the satellite into the Ariane double-launch system in the case of a twin launch;
- installation in the payload container.

The schedule of stage-2 activities for the satellite taken as an example is given below [Table B].

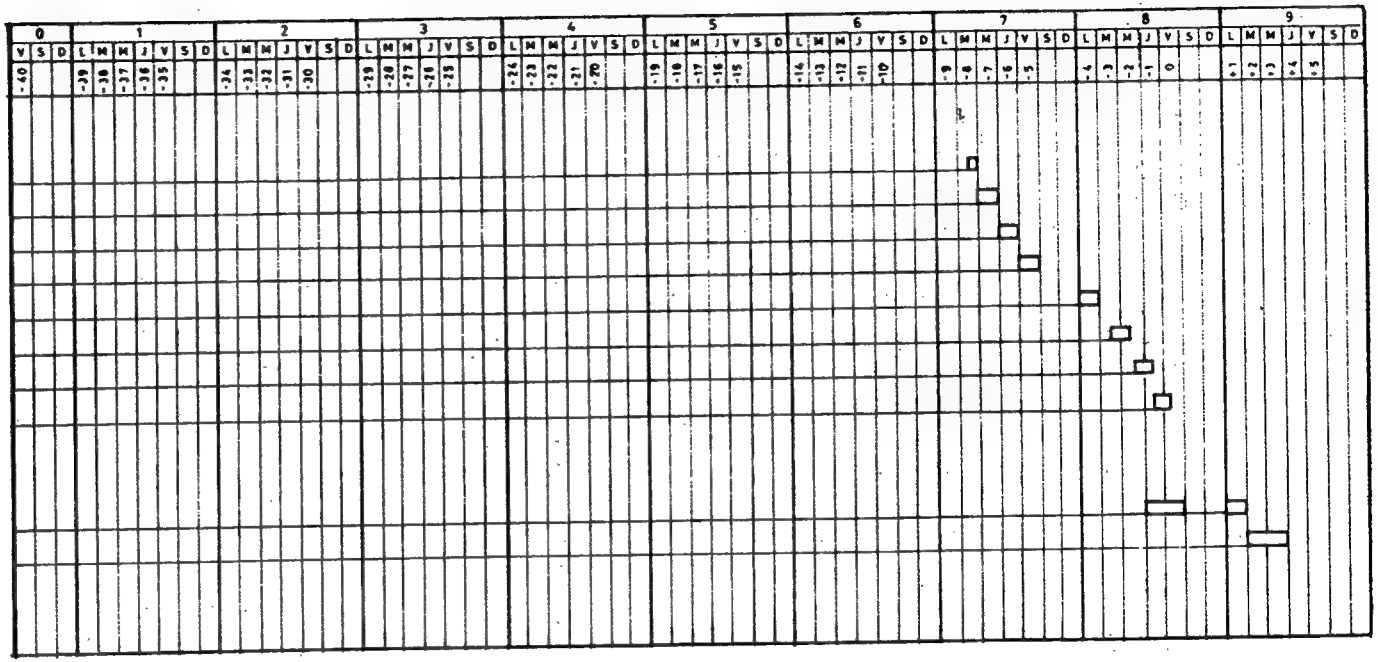
Stage 3--Launch-Area Operations

On the launch area, payload operations are related to launcher operations and are part of the "Combined Operations Plan" (POC).

The launch area consists of the launch pad and the Launching Center (CDL). On the launch pad is the Ariane tower in which the launcher is erected on its launching table; the tower surrounds the umbilical mast which supports the fluid pipes and the electric connections connecting the launcher and the payload to ground facilities.

Operations

Day:



Satellite on Launcher

Payload container transfer to PF8
Composite-launcher assembly
Functional electric tests
Nosecone installation checks
RF tests--Launcher compatibility
General rehearsal
Launcher + satellite preparation
Countdown

Return Preparation

Packing
Return freight operation follow-up

Table C. Stage 3: Schedule of operations

Key: L: Monday; M: Tuesday; M: Wednesday; J: Thursday; V: Friday; S: Saturday; D: Sunday

Platforms provide access to the various stages; access to the payload level is provided by platform No. 8 (PF8). This platform can be moved up and down and forms the floor of a clean zone (Class 100,000). The Launching Center is an armored building providing for personnel and equipment safety during the final preparation and during the launch. This building houses, in particular, the check-out bays connected to the payload by umbilical links; the video-transmitted functions using the umbilical links can be forwarded to building S1 through a radio-relay system.

The operations of stage 3 can be summarized as follows:

- transfer of the payload to the tower, in the payload container;
- erection of the payload container on platform No. 8;
- assembly of the payload to the launcher;
- check-out and validation of the umbilical links and of the enabling and disabling controls of hazardous systems;
- functional check-outs;
- compatibility between the payload and the launcher concerning radio emitting-receiving;
- launch-aptitude review (RAL);
- general rehearsal of the countdown;
- charging the batteries;
- enabling (removal of safety devices);
- putting the electric or radio systems in the flight configuration; final remote enabling;
- countdown and launch.

The schedule of stage-3 operations for the satellites already considered in stages 1 and 2 is given below [Table C].

3. Combined Operations Plan (POC)

General Rehearsal

Although this exercise does not involve specifically check-outs of the launcher or the payload, it is important to mention it here; its goal is to make sure that there is perfect coordination between the people in charge of the launch (COEL [Head of Launch Site Operations]), the launching base, the Director of Operations (DDO), and the people in charge of downrange stations (Natal, Ascension, Akakro). It also provides an opportunity to check the quality of the means of liaison between these various points.

The various centers are working simultaneously to put the launcher in the configuration where it is "ready for synchronized sequence" and report to the COEL console to authorize (or prevent) the start of the fictitious synchronized sequence during which all outer parameters of the launcher and of the payload that are put into the interdiction loop can prevent the unfolding of this sequence.

POC Operations

- Composite/CCU transport & hoisting on PF8
- Integration of second flight PA
- Installation of payload on launcher
- Final prep. of nosecone at S3A and return to CTC
- Second long calibration of instrument pack
- Hoisting CTC on PF8 and nosecone assembly
- Final launcher preparation
- General rehearsal (RG)
- Launching aptitude review (RAL)
- Filling 1st and 2nd stages with propellant agents
- FINAL COUNTDOWN

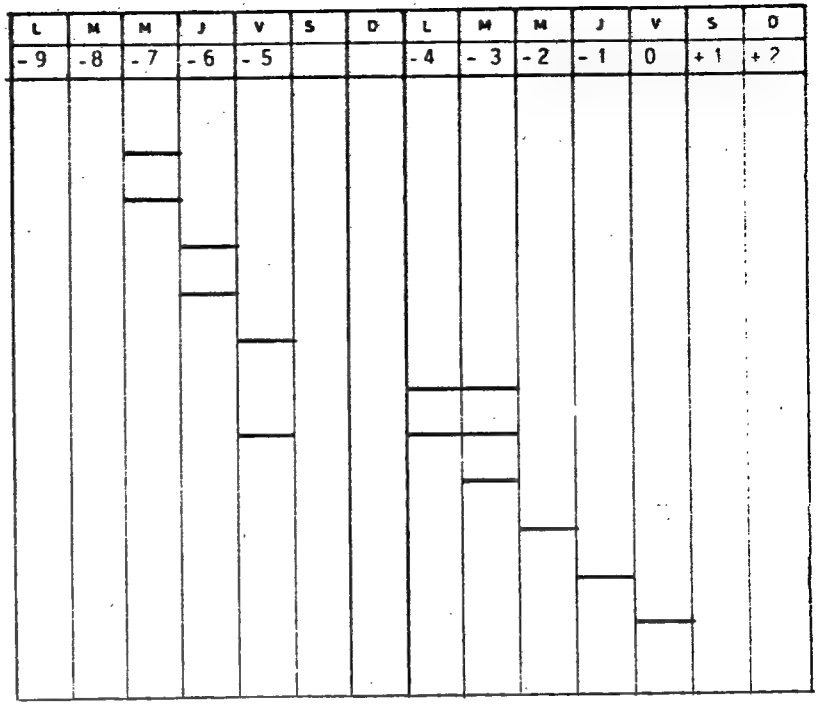


Table 2. POC Operations

Key: L: Monday; M: Tuesday; M: Wednesday; J: Thursday; V: Friday; S: Saturday; D: Sunday

Launch Countdown

Before tackling this ultimate preparation stage, the stages and the payload are placed in the final configuration. These operations consist essentially in removing the latest signal flags (indicating a last-minute operation), installing the flight batteries, prelubricating the third-stage turbopump, installing the pyrotechnic components, cleaning the pneumatic and propellant circuits, putting the various capacities under pressure, removing the access floors, closing the various doors of the launcher, and making a final visual inspection. At this time, a long calibration of the inertial unit is also made.

Once these tasks are completed, there is a pause of about one day in the operations, and attention then focusses on the launch-aptitude review (RAL), whose difficult task it is to check that all the operations initiated during the launcher life, whose completion is a prerequisite to the authorization to start the countdown, have been satisfactorily completed. During this review, all outstanding incidents that occurred during the campaign are mentioned and the way in which they have been handled is explained.

After the launch-aptitude review, when the launcher and the payload are declared "fit for service," the launch countdown can start. This stage, which lasts about 28 to 29 hours, consists of some 120 tasks, both at the ground facilities and on the launcher and the payload.

They can be divided into thre main parts:

First Part:

- filling the first and second stages with storable propellant agents (UH_{25} and N_2O_4);
- pressurization of the propellant tanks to stand-off values lower than flight pressures (safety of the personnel working nearby);
- during this period, the propellant quantities are adjusted to the values required, taking into account the performance desired and the filling temperature.

Second Part:

Intermediate stage during which operations focus essentially on ground facilities (tower, check-out bench, Guiana Space Center resources). Operations on the launcher consist essentially in disassembling the access floors and some of the pyrotechnic system controls (passive state, in particular).

Third Part:

This is the ultimate phase prior to launching. It involves filling the third stage with propellant agents (liquid oxygen and hydrogen) and adjusting the propellant tanks of the first and second stages and the high-pressure containers of the various service fluids (He, N_2) to flight pressures. In addition, the electric chains are put to work (application of ground voltage, checking certain parameters), a last launcher/safeguard station compatibility test is made and the flight program is loaded.

Countdown Operations

- Ground installations put in filling configuration
- Second-stage N_2O_4 tanks filled
- First-stage N_2O_4 tanks filled
- First-stage UH_{25} tanks filled
- Second-stage UH_{25} tanks filled
- Launcher and tower preparation
  (floor removal, disconnect, pyro systems check-out, inertial unit started)
- Preparation for third-stage tank filling
  Site cameras set
- Third stage cooled
  First and second-stage pressurization complement
- Third-stage tanks filled - Electric chains started - Flight program loaded
- Payload placed in internal configuration
  Unfolding of the synchronized sequence

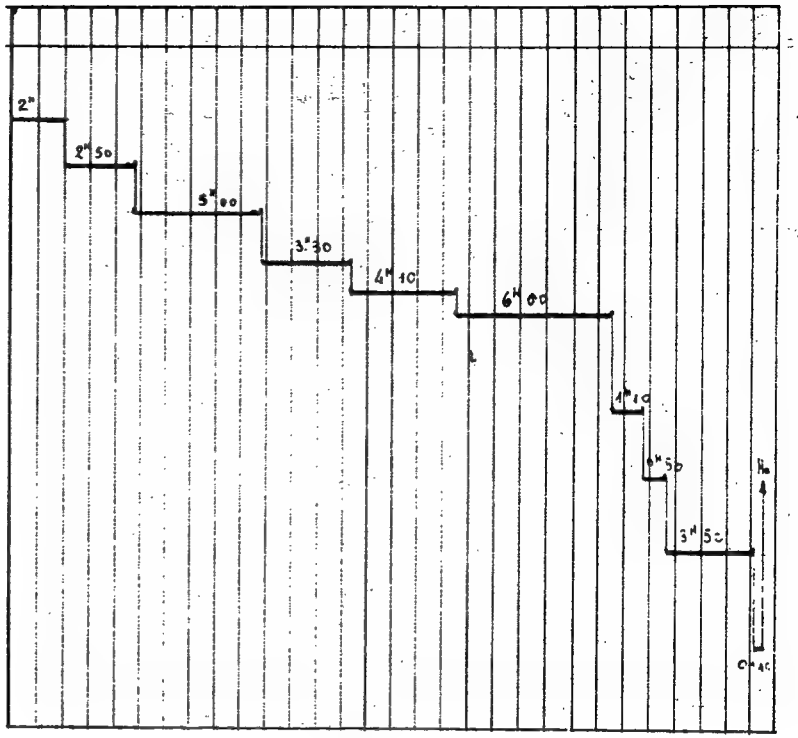


Table 3. Countdown Operations

Finally, the module of preparation to the synchronized sequence is unfolded by computer K1 (which governs electric systems), while computer K2 also places the fluid systems in the stand-off configuration.

The "ready" signal for the synchronized sequence is sent by each of the computers when the last parameters checked have been found correct (pressures, temperatures, voltages, currents, passive or active state of the electric and fluid systems, etc.).

Synchronized Sequence

It includes only indispensable operations that could not be carried out before. It starts in negative time, at H_0-6 minutes and continues until H_0+8 seconds. The check-outs are made automatically by the two computers (K1 and K2) of the launcher check-out bench (BCL). Any anomaly detected during this sequence automatically interrupts the sequence and requires the systems to be returned to the initial configuration (RCI). This initial configuration depends on the moment when the countdown interruption occurs and on the system involved. As a rule, any incident will make it necessary to resume the countdown at H_0-10 minutes. For the propellant or pneumatic systems, this will often require rather long refill operations (of the order of 15 minutes) to return to the correct configuration of the start of the synchronized sequence.

After H_0-4 seconds, it is no longer possible to return to the initial configuration and, if there is an anomaly and if the launcher has not taken off (which is usually the case), the launcher check-out bench computers will start a backward sequence called "aborted launch."

Simultaneously with the sending of the last orders to put the launcher in its final configuration (enabling of the pyrotechnic systems, opening of the pneumatic system valves, putting the hydraulic systems of the piloting chain under pressure, putting the third-stage propellant systems under flight pressure, switching the electric chains to the flight power supply, etc.), the computers are monitoring the execution of these orders and the values of certain parameters deemed critical for the launch (values of the controlled deflections of the nozzles of the three stages, pressure in the third-stage helium sphere, pressures in the high-pressure batteries of the piloting systems, pressures of the third-stage propellant tanks, battery power output or voltage, first and second-stage pilot pressures).

At H_0-5 seconds, monitoring of all the above-mentioned parameters is discontinued, and at H_0+2.8 seconds, following an order from the launching-stage automatic control (APL)--the control-bench component that sends orders to the ground and to the launcher starting at H_0-4 seconds--the two computers K1 and K2 start monitoring the motor parameters of the L140 (hearth pressures and injection pressures of the four motors) in order to process them according to a predetermined logic and, if need be, to prevent the opening of the retaining hooks of the launcher.

At H_0+8 seconds, this monitoring stops. At H_0+7.8 seconds, the launching-stage automatic control sends an order to stop the first-stage motors, which can be executed only if the launcher has not cleared the launching table (rupture of straps located at retaining-trunnion level). The hooks close again and, at H+8 seconds, the launching-stage automatic control sends to K1 and K2 the authorization to start the program of return to the initial configuration.

Conclusion

In the above, we have shown with how much care the various equipment check-outs are made and repeated before the launch; it is important to point out that all this is made possible only by the difficult and competent work of some 150-200 technicians helping the head of launch-site operations (COEL) and the head of the payload (RCU).

PHOTO CAPTIONS

1. p 58 Ariane-3 launcher on the launching table.

2. p 58 Ariane-3 launcher equipped with its powder-propellant booster propulsion units.

3. p 59 Launcher check-out bench: head of launch-site operations' and safeguard consoles.

4. p 59 Launcher check-out bench: in the foreground, K1 and K2 computers; in the background, propellant-agent consoles.

5. p 63 Building S1: preparation of a satellite.

6. p 64 Building S3: satellite being filled with propellant agents and pressurized.

7. p 65 Building S3: integration of satellites with the Ariane double-launch system.

8. p 65 Payload transfer to the tower, using the payload container.

9. p 66 Payload (with Ariane double-launch system) mounted on the launcher before installation of the nosecone.

9294
CSO: 3698/454

AEROSPACE

FINLAND PLANS PANEL TO STUDY SPACE POLICY

Helsinki UUSI SUOMI in Finnish 27 May 85 p 11

[Article: "Advisory Panel on Space Issues for Finland"]

[Text] The government is trying to create a "consistent course of conduct in space policy" for Finland by establishing an advisory panel on space issues to assist the Ministry of Communications. An ordinance on the matter was issued Friday.

A work panel which plans new national space activity is considered necessary, among other things, for improving cooperation among various institutes, for concentrating the collection of information, and for managing international relations. Telecommunications satellites have the greatest economic significance from Finland's viewpoint, according to the Ministry of Communications.

In addition to telecommunications, space activity has an important role in weather-forecasting service, navigation, natural science and satellite mapping of the earth. Space activity requires technological advancement because of which participation in it is essential from the standpoint of Finland's industrial development, states the Ministry of Communications.

The new advisory panel must make proposals and reports which, to a certain degree, will be the basis of space policy decisions.

The advisory panel has to take into account technical, scientific, national economic, international as well as cultural and communications viewpoints. The State Council will appoint a chairman, vice-chairman and 12 other members to the advisory panel.

12327
CSO: 3698/461

AEROSPACE

BRIEFS

ARIANE INSURANCE--On 15 May, Mr Hubert Curien, minister of research and technology, announced that the French government had started negotiations with insurance companies for a reassessment of the risks involved in space launches under the Ariane program. During the questions to the government, answering the socialist deputy Jean-Michel Boucheron (Ille-et-Vilaine, Brittany), according to whom insurance companies represent "obstacles" to the development of the French space program, Mr Curien assured that it was "accurate" to say that the insurers' demands "did not reflect an objective analysis of the risks." Insurers, he indicated, had to pay off $300-400 million in 1984 as a result of several failed launches. But, he added, the French method is "safer" than the use of a shuttle as it is practised in the United States. [Text] [Paris AFP SCIENCES in French 15 May 85 p 19 bis] 9294

CSO: 3698/475

BIOTECHNOLOGY

STATUS, OUTLOOK FOR BIOTECHNOLOGIES IN FRANCE

Paris AFP SCIENCES in French 15 May 85 pp 56-61

[Article: "Biotechnologies in France: Status and Future Prospects"]

[Text] Paris--At a cabinet meeting on 15 May, Mr Hubert Curien, minister of research and technology, presented a communication on biotechnologies, which had initially been scheduled several weeks ago.

In his intervention, Mr Curien reported on the present status and outlined the future prospects of biotechnologies in France, where they are covered by a mobilization program "Development of Biotechnologies" that was started in July 1982.

These technologies, which turn the living cell into a tool that could transform many productions and processes in various industrial sectors, actually represent a veritable revolution.

The present public research effort is estimated at FF 800 million and involves the large research organizations. In addition, there are subsidies under the mobilization program (FF 200 million since 1982), and loans from the ANVAR [National Agency for the Implementation of Research] and the Industrial Modernization Fund, which have considerably helped in supporting this research, by encouraging cooperation between public organizations and industrial firms.

The most spectacular progress was made in the pharmaceutical sector. In fact, during 1984 alone, the four largest companies spent over FF 500 million for research and development:

- Rhone-Poulenc (fermentations) and its Genetica subsidiary (genetic engineering) created a company, Bio-Europe, in partnership with Sugar Union;

- SANOFI [Aquitaine Financial Corporation for Hygiene and Health] invested large amounts in research on genetic engineering and fermentations (Elf-Bio-Research Center of Labege) and in the sector of cell fusion and monoclonal antibodies through its Clin-Midy subsidiary in Montpellier;

- Roussel-UCLAF in the fermentation, enzyme engineering and genetic engineering sectors;

- Merieux Institute/Pasteur Institute-Production in vaccines;

- UPSA [expansion unknown] in interferon.

Still in the same pharmaceutical domain, biotechnologies also concern newly created companies such as:

- Transgene (genetic engineering) and Immunotech (immuno-diagnostic);

- Clonatec (monoclonal antibodies), Biosys (immuno-enzymatic diagnostic) and Oris (in-vitro/in-vivo diagnostic).

One example of close collaboration between the public and private sectors was mentioned by the minister: the Intergene program on which several organizations are working jointly, such as the Ministry of Research and Technology, the ANVAR, the INSERM [National Institute for Health and Medical Research], the CNRS [National Center for Scientific Research], Bio-Merieux, Immunotech, Transgene, for research in the field of in-vitro reagents.

In the field of agriculture (seeds and plants) many INRA [National Institute for Agronomical Research] laboratories are working to improve plants; large companies such as Clause-Limagrain, Rhone-Poulenc-Agronomy, are making heavy investments; and the INRA research centers, the Pasteur Institute, the CNRS, Elf, CDF-Chemistry [French Coal Mines] and Rhone-Poulenc are carrying out research on the symbiotic fixation of atmospheric nitrogen.

The agrifood sector, although the leading sector in which these technologies should find applications, "has until now remained paradoxically aloof from recent developments in modern biology."

In this sector, the companies most actively engaged in biotechnological research are:

- in the dairy industry: BSN [Boussois-Souchon-Neuvesel; Gervais-Danone], Bongrain, Bel-ULN [Normand Dairy Union-Fromancais], Sodima Yoplait;

- in the beverage industry: Pernod-Ricard, Moet-Hennessy;

- in the bread-making sector: Jacquet-Duroi Bread;

- in the sector of corn by-products: Roquette;

- in the sector of additives based on corn and wheat intermediate products: CECA-Rousselot, Lafarge-Coppee group.

In the energy sector, a program was set up and coordinated by AFME [French Energy Management Agency] to develop the use of the agricultural and forest biomass. The production of alcohol from the biomass, to be used as a fuel substitute for oil, could serve to convert part of the European agriculture which is affected by the crisis.

Considering the many achievements and promises of the mobilization program "Development of Biotechnologies," Mr Curien emphasized the scope of the tasks to be undertaken in the future and of the priorities on which efforts must be focussed during the next few years, not only in the field of basic research, but also in that of industrial developments.

Choices must be made, for there are sectors in which France "is still disturbingly behind":

- in microbiology, where problems are essentially training problems;

- in enzyme engineering where support should be provided for research on bioreactors, whose industrial applications are beginning to emerge.

In view of this situation, the Ministry of Research and Technology decided to reorganize the mobilization program once again to meet these imperatives.

As a result, the following will be created:

- a "Program Council" of 20 members appointed by the minister and including all those who take part in the development of biotechnologies was created [as published]. It includes competent personalities of the technical and industrial world, scientific personalities belonging to the various organizations and research institutes involved, and representatives from the Ministries of Research, Agriculture, Industry and Health;

- a "Directorate of Projects" whose task it will be to translate the guidelines of the Program Council into goals. The program director will be the sole person in charge of carrying out the efforts required in the various domains (agrifood, pharmaceutical and chemical industries, logistic support to biotechnologies). He will be assisted by four delegates and a series of experts;

- the mobilization program will also have to integrate "the necessary European dimension." "Indeed, it would be difficult to achieve all these objectives without real cooperation on European programs," the minister of research, Mr Curien, pointed out, and he himself insisted that the "Eureka" project should also be open to biotechnologies, even if it does not have a biotechnological dimension.

For 1985-1986, several projects with a European dimension were started:

- strengthening the ties between European teams working on joint research programs;

- setting up strain and gene banks in Heidelberg, to be available to researchers and manufacturers; and finally

- setting up a French-German industrial research cooperation associating public organizations and companies in the two countries.

Here are the specific data sheets provided by the Ministry of Research and Technology concerning the various sectors in which biotechnologies find their applications and in which research is being made.

Biotechnologies and Agriculture

1. Plant Improvement

The "seeds and plants" sector, although of strategic importance for our country, is of small economic import (sales of FF 6.2 billion for the 1982-1983 season).

Most companies in this sector are family enterprises and cannot afford any research.

Many INRA laboratories are working on plant improvement--cell cultures, tissue cultures.

In the private sector, large companies are striving to increase their investments.

Clause-Limagrain--research contract with the Faculty of Sciences of Clermont-Ferrand and with the INSERM.

Moet-Hennesy invested to improve grapevines and rose-bushes.

Rhone-Poulenc-Agrochemistry is working on the selection of sunflowers (agreement with Calgene U.S.).

Regroupings are taking place. Thus, the ADAR (Association for the Implementation of Research Applications) headquartered at the plant-improvement laboratory of the Orsay Faculty.

2. Plant Protection

While traditional phytosanitary products are issued from chemical synthesis, research is now developing on the themes of biological control (insects, etc.) and on the creation of disease-resistant varieties.

3. Symbiotic Fixation of Atmospheric Nitrogen

A first research contract was signed by the INRA, the Pasteur Institute, the CNRS, Elf, CDF-Chemistry and Rhone-Poulenc.

Biotechnology and Fine Chemicals

According to a pragmatic definition, fine chemicals are all products whose price per kilo reaches or exceeds 15 Swiss Francs.

If we except active pharmaceutical substances, France excels in two major product categories:

- technical additives and flavors;
- products of the third or fourth transformation of starch.

Concerning industrial enzymes, SANOFI and Roussel-Uclaf are producing them in the health sector, and Roquette Freres for sugar biochemistry.

Two companies just started specializing in the production of ferments:

- Lactolabo, a Rhone-Poulenc subsidiary (lactic bacteria, molds, yeasts);
- Eurozyme: production of micro-organisms (seed yeast for the direct seeding of milk in cheese-making).

Among technical additives, there are the amino acids:

- ORSAN [Santerre Organic Products] (glutamic acid);
- Eurolysine (lysine);
- AEC [expansion unknown] (methionine).

Similarly, France is in a strong position for texturizing agents:

- Rhone-Poulenc Chemical Specialties: xanthan gum.

As far as milk fractionation is concerned, it regroups several manufacturers on a market whose outlets are the pharmaceutical and cosmetic industries.

Public research is regrouped in four institutes:

- the enzyme technology laboratory of the Compiegne University (under private contract):
  - recycling of pyrimidine cofactors;
  - hemoglobins with pharmacological applications;
  - enzyme electrodes.

- the enzymology laboratory of the Toulouse INSA [National Institute for Applied Sciences]:
  - development of reagents for the agrifood industries (enzymatic hydrolysis of saccharose, enzyme fixation on corn cobs);

- the IRCHA [National Institute for Applied Chemical Research] whose research has been oriented to two fine-chemistry themes since 1982:
  - bioreactors: production of new membranes for fermentation applications;
  - production of synthetic peptide intermediate compounds with very high added values (amino acids, oligopeptides, phosphorus derivatives);
  - industrial contracts for the development of processes to produce organic acids through bioconversion.

- French Petroleum Institute:
  - production of polysaccharides from methanol;
  - production of enzymes.

Intergene Program

The Intergene program associates the following to develop and accelerate research in the field of in-vitro reagents:

- the government (Ministry of Research, Anvar) for a program of aid to innovation;

- bioMerieux, the leading French reagent producer, for its development capacities, its knowledge of the biological market, and the fact that it is represented on foreign markets;

- and large private or public research organizations for collaborations that have already materialized (INSERM, CNRS) or potential collaborations (Immunotech, Transgene, Rhone-Poulenc).

The Intergene program now has two priority orientations:

- research on the use of latex particles for rapid diagnostic;
- research on immuno-dosages with non-isotopic markers.

These two orientations have the advantage of being material goals and corresponding to actual needs in industrialized and developing countries.

This research associates the following:

- 7 bioMerieux research laboratories where 37 people are working on the program (immunochemistry, enzymology, radioimmunology, bacterial immunology, parasitic and viral immunology, monoclonal antibodies and enzyme purification, the last two laboratories providing bioMerieux with increasing independence as far as biological raw materials are concerned);

- external collaborations that must be expanded: contracts with the INSERM U58 (Montpellier) and U34 (Lyons) units; CNRS unit (Solaize).

Research for the Intergene program was covered by a first quarterly report (June 1984). Our efforts focussed on Elisa seroimmunology, on the development of the corresponding instruments in cooperation with the Statice Company (Besancon), on new methods using bioluminescence in hormonology, and finally on research on latex particles to optimize their qualitative and quantitative utilization.

Some reagents benefited by priority from the acceleration effect generated by the Intergene program and will be ready early in 1985.

The Intergene program has potentialized the efforts of bioMerieux along two development orientations: latex and immunoenzymology.

The Intergene program makes it possible:

- to step up the technological effort for traditional reagents and new technologies;

- to federate a number of public and private French research teams;
- to retain thus the competitiveness indispensable to the international development of French reagents.

9294
CSO: 3698/477

BIOTECHNOLOGY

BRIEFS

BRITISH BIOTECH R&D PROGRAM--$100 million over 5 years: the new program of basic research on biotechnology that the British are now refining should enable academics to cooperate with public and industrial laboratories. Each party, public and private, will have to contribute about 50 percent of the amount in order to enable the agrifood sector to complete a decisive stage in its reorganization. Three British research councils will take part in the project, as well as five of the largest agrifood groups: Shel, ICI [Imperical Chemical Industries], RHM [expansion unknown], Cadbury's-Schweppes and Unilever. This new program, covering the animal, plant and food sectors, should be carried out simultaneously with the matching EEC program. [Text] [Paris AFP SCIENCES in French 15 May 85 p 62] 9294

CSO: 3698/477

CIVIL AVIATION

BRIEFS

AIRBUS INDUSTRIE REORGANIZATION--On 14 May, the European consortium Airbus Industrie, which is now headed by Jean Pierson after the departure of Bernard Lathiere, announced that it had reorganized its overall operations by creating seven major departments instead of the previous five. Among the new managers, who are reporting directly to Mr Pierson and Mr Johann Schaeffler, assistant managing director and general manager, we note the names of Messrs Bernard Ziegler (France), in charge of engineering (including flight tests), and Jean Roeder (Luxembourg), head of the department of technology and new product development. [Text] [Paris AFP SCIENCES in French 15 May 85 p 12] 9294

CSO: 3698/475

COMPUTERS

SIEMENS OF FRG INTRODUCES IBM-COMPATIBLE SUPERCOMPUTER

Stuttgart BILD DER WISSENSCHAFT in German Jan 85 pp 28-29

[Article by Uli Deker: "Supercomputers Now Also Made by a German Manufacturer"]

> [Excerpts] Up to now the supercomputer market was shared by only two companies: the Cray Research Specialists and the Control Data Corporation (CDC). Siemens plans in the beginning of 1985 to enter this competition and deliver its first systems.

"Supercomputers" are characterized by their ability to perform calculation processes at especially high speed and handle large masses of data. Their trick: they don't compute in successive steps but perform several steps simultaneously. In addition, they employ the fastest circuitry and thus attain a very short cycle time. In the case of the current champion, the Cray X-MP, this cycle time amounts, for example, to 9.5 nanoseconds, performing more than 100 million elementary operations per second.

More interesting is the number of "floating point operations." This refers to complete additions and multiplications of numbers. Here, the Cray X-MP attains values up to 240 megaflops (millions of floating point operations per second). Large computers designed for general application are inferior in this regard. For example, the IBM-3081 is capable of "only" 2 megaflops.

The VP100 and VP200 supercomputers produced by Siemens' Japanese contract partner Fujitsu, which are to enter the market in the first quarter of 1985 have a cycle time of 7.3 nanoseconds and a maximum performance of 250 and 500 megaflops, respectively. But these values admittedly are heavily dependent upon the structure of the problem. Only when the latter permit parallel processing is the full capability of the computers obtained.

The Siemens computers have at their disposal essentially two pipelines for storage and loading of data as well as one pipeline each for addition, multiplication and division. In these computers the number of vector registers may vary between 8 and 256 depending upon the length of the vectors or in other words depending upon the number of their components (between 1,024 and 32 in the VP200). For individual number 64 bits are reserved. Thus, for example,

it is possible to operate with numbers between 10^{-2466} and 10^{2466} with 15-place accuracy.

Another special feature of the Siemens computers are the so-called mask registers. In these a 0 or a 1 is associated with each vector register depending upon whether it is to be included in the next operation or not. This yields a further increase in efficiency.

Hitherto, the only parties interested in supercomputers costing DM 10 to DM 40 million have been large scientific-technical institutions. The Cray 1, Cray X-MP and the Cyber-205, respectively, installed in the FRG may be counted on the fingers of one hand.

Nevertheless, a wider market now seems to be becoming interested in these machines. Their possible areas of application include, in addition to weather prediction (the standard example), the design of very highly integrated chips (VLSI), crash analyses in automobile construction or wind tunnel simulations for newly designed aircraft.

Siemens sees special opportunities in the fact that its supercomputers are IBM-compatible and therefore can be integrated into suitable computing centers without the expense of additional personnel. Interested parties can climb aboard for DM 16 million and for this will obtain the VP100 with 32 megabytes of main memory capacity and 16 I/O channels.

8008
CSO: 3698/407

FACTORY AUTOMATION

BOSCH OF FRG INTRODUCES ROBOT WITH SWINGING ARM

Coburg MASCHINE + WERKZEUG in German 7 Dec 84 pp 21-22

[Article: "Bosch Is Betting on the Automation of Manufacturing: Investment in Robots"]

> [Excerpts] "Of our million-mark investment program about 25 percent goes into the technology of assembly and manipulation," the Bosch management recently reported at a press conference in Stuttgart-Feuerbach. With a view toward the future as a challenge filled with many opportunities the Schwabians introduced not only a new product line of swinging-arm robots but also an entire flourishing area of business in industrial equipment.

"The answer knows only the wind." Anyone who asks for a definition of the technical term "flexible automation" feels reminded of the formerly popular song of the sixties. But now in the beginning of October in Stuttgart-Feuerbach at a press conference of the Robert Bosch Company on the occasion of its product presentation of the new swinging-arm robot SR 800 it was possible to get an answer to this question. Although somewhat long-winded it did deal clearly with the problems involved:

A Solid 4-Billion-Mark Market

"We are basing ourselves on the assumption that the market volume for manufacturing automation in the FRG will be as much as DM 4 billion." This is the analysis of the manager of the Bosch industrial equipment division, Dr Engr Rainer Hahn. "The FRG growth rate will probably be around 15 percent," according to Dr Hahn. In 1983 the manufacturers within the "assembly, manipulation, industrial robot--i.e., MHI" division of the VDMA representing industries throughout the West German states achieved total sales of DM 2.1 billion. Here the annual growth rates are estimated to be about 20 percent--with an above-average increase in flexible assembly systems being expected.

The Stuttgart Fraunhofer Institute for Production Technology and Automation (IPA) has also been studying these questions. In accordance with a just-published study it has been established by means of a representative questionnaire that at the present time about 25 percent of all industrial investments

go into the area of assembly operations and it is expected that by the year 1987 there will be an increase in this figure to 29 percent. It is conjectured here that then about 50 percent of this volume will be in the area of assembly automation.

It is hardly necessary to mention that the billion-mark Schwabian vehicular and industrial equipment company Bosch (world sales for 1984 more than DM 15 billion) occupies a leading position in this area of activity. On the one hand the company is offering standardized construction units with which the client can himself construct his own facilities in accordance with his own plans. On the other hand the business division is offering complete customer-tailored engineering solutions which to some extent also range beyond the area of assembly technology. It is expected that also a modular system of construction units possessing a high degree of standardization will also permit the efficient use of electronic data processing in the planning and design of assembly systems.

Altogether in the industrial equipment division today at four localities in the FRG (Stuttgart, Erbach, Waiblingen, Karlsruhe) and at one location in the United States there are employed about 1,800 workers in the development and production of assembly and manipulating systems, of electronic controls and guidance systems for automated manufacturing, besides being engaged in the manufacture of deburring facilities. The turnover volume achieved in 1983 was DM 360 million. The Schwabians also expect that in the future there will be "a distinct growth" here.

The promptness with which Bosch recognized the importance of the robot in the automation of assembly deserves to be acknowledged. As early as 1971 the industrial equipment division has been occupied with the development and use of the robot. Thus a prototype for heavy loads (up to 50 kg) developed by Bosch and put into operation in 1976 was probably the world's very first functioning swinging-arm robot.

Today, Bosch staff member Peter Drexel as manager of development and design in machine construction and assembly technology lists the following essential requirements which robot systems must meet:

i. very short cycle times (about 2.5 to 10 sec/activity),

ii. low workpiece weights (about 90 percent of the cases less than 5 kg),

iii. high precision = +/- 0.05 mm,

iv. preferred motion direction vertical: about 80 percent of all qualified movements in the Z direction,

v. very favorable price/performance ratio: a new price category for industrial robots is now opening up,

vi. simple user interface: problem-oriented programming in German or in the particular national language of the user,

vii. efficient peripheral equipment for process technology and material flow.

These are requirements which are satisfied for the most part by portal robots and linear robots. Nevertheless, it is only with swinging-arm-type robots that, in the speaker's view, a particularly broad and optimal coverage of the requirement profile can be achieved. In Feuerbach speaking to the press Peter Drexel listed as specific strengths of this device the following:

i. high precision in all three directions,

ii. high rigidity in the Z direction (vertical),

iii. capability of being powered in the Z direction,

iv. elimination of inertial force from the primary axis drives,

v. stability of the axis position in the Z direction permits seam work with very tight workpiece play,

vi. possibility of easy synchronization of the workpiece installation in the X-Y plane,

vii. large working area in proportion to structural size,

viii. compact, economical structural form.

The SR 800 swinging-arm robot is a machine which is freely programmable in up to four axes. Its stable cast design in conjunction with a solid mounting and with an adequately dimensioned drive system promise the robustness which production use requires.

8008
CSO: 3698/406

FACTORY AUTOMATION

BRIEFS

COMPUTERIZED MILLING SHOP--The Nantes factory of Aerospatiale has just placed in service a computerized piloting and management system at its milling workshop, the first such system in France. It was designed by a subsidiary of SODETEC [expansion unknown], the SODETEC-TAI Company (Transmissions-Automation-Data Processing) belonging to the Thomson group, and is called direct numerical control (DNC). It was introduced to the press on 13 May at the factory. The DNC does not just control the automatic milling of aircraft structural parts, but it monitors all current operations and the conditions of the machine inventory. It also manages ancillary services such as inventory and maintenance. It took about two years to design and develop the DNC. It cost a total of FF 15 million. Sixty machines can be connected to the system whose introduction at the Nantes factory did not involve any alterations of installed milling machines. The Nantes factory of Aerospatiale is expecting productivity gains of 8 percent to result from improved machine use, improved production and the elimination of ancillary costs. The factory employs 2,400 people. Its sales amounted to FF 874 million, exclusive of taxes, in 1983. The bulk of its activity focusses on the Airbus, ATR.42 and ATL.2 programs. It also produces the vertical stabilizer of the Mirage 2000. [Text] [Paris AFP SCIENCES in French 15 May 85 p 29] 9294

CSO: 3698/475

MICROELECTRONICS

ITALY'S SGS-ATES FORGES AHEAD UNDER NEW LEADERSHIP

Aarau ELECTRONIQUE in French Sep 84 pp 28-29

[Article by Pierre-Henri Badel: "Sicilian From America Revitalizes SGS"]

[Text] Says Pasquale Pistorio, CEO [chief executive officer] of SGS [General Semiconductor Company]: "In 1980, SGS was, according to Dataquest, in 23rd place in the semiconductor market. In 1983, it rose to 20th place. It was the only company to have improved its position. We chose to invest in our future. And success begets success. We believe that SGS now has the ingredients it needs--financial and human resources, know-how and a motivated management--to continue its growth."

The Italian company SGS-ATES Componenti Elettronici SpA [SGS-ATES Electronic Components Corporation] is the parent company of the SGS group of enterprises; it is an international company based in Italy and specializing in semiconductors. It was formed in 1972 through the merger of the SGS and ATES companies, both of which had been specializing up to that time in semiconductors. The SGS-ATES company is attached to the financial group STET [Telephone Finance Corporation], which in turn comes under the Italian IRI [Industrial Reconstruction Institute], the spearhead of the enterprises owned by the Italian Government.

The SGS company had not earned a profit in 10 years when, in 1980, irritated by this situation, it decided to institute Draconian measures to get back into the black. It took the dynamism of the Sicilian Pasquale Pistorio to rise to this challenge. At the age of 44, with 17 years of experience in American management techniques, and vice president of Motorola at the time, he began by recruiting a number of corporate officers with experience in American methods and technologies.

A Red-Letter Year

1983 was a pivotal year for SGS. That year it had a revenue of $230 million, representing a growth of 32 percent over the preceding year. In the course of 1983, SGS again turned profitable for the first time in some 10 years. To attain this objective, Pasquale Pistorio's formula was simple: For him, it meant working from 7 am to 8:30 pm. But it also meant levying a demanding

pace on his management staff and on STET, requiring of the latter an investment of $500 million over a period of 10 years to modernize the company's production facilities.

Production centers were built in Malaysia (1,300 employees), Singapore (1,500 employees), Rennes (400 employees), and Malta (over 500 employees). The production centers in Malta and the Far East were set up to benefit from the advantages of low labor costs. The fact is that even in its Italian plants at Agrate, near Milan, and Catania (Sicily), production costs are much too high to meet international competition. This move of part of its production centers was not made without inflicting pain. It meant the laying off of 900 of the enterprise's 8,000 employees. In 1980, the Catania plant was considered a low-cost production center. Actually, this was not the case. Its production cost exceeded the selling price. Mr Pistorio concedes willingly that this redistribution of production was not accomplished painlessly: "The principal difficulty I had to deal with after taking over as head of the company was cutting down the size of the staff employed at Catania." Now that the streamlining program is complete, Mr Pistorio's goals are clear: To attain a revenue of $1 billion in 1988, and rank among the top 15 companies in microelectronics.

American Market Offensive

The key to SGS's growth lies in its conquest of the American market. In 1980, this market represented only 8 percent of the company's sales. By 1983, this ratio had risen to 30 percent, representing $65 million. The Asian and Pacific region also showed an increase, from 6 percent in 1980 to 16 percent in 1983. An IC [integrated-circuit] diffusion facility is to be opened shortly at Phoenix to serve this market, together with the design center that is already installed there. The SGS company is organized according to a matric model structured by product and by region. Four product divisions--bipolar IC's, MOS IC's, discrete components, and systems--are consolidated at the marketing level into three geographical sectors: Europe, the Americas, and the Asian and Pacific region.

Bipolar IC's

In 1983, this sector represented 45 percent of the company's revenue. While in this domain the general average growth of the branch is 20 percent, that of SGS was 36 percent in 1983, and is expected to attain 50 percent this year.

The manufacture of silicon chips is done in the Agrate plant (3-, 4- and 5-inch wafers), the Castelletto plant and the Rennes plant (3-inch wafers). Presently, the Agrate plant's 5-inch-wafer production line is the only one of its kind in Europe. It has been in operation since spring. Joining it will be the 5-inch-wafer production unit at Rennes, which is to be put in service around the end of this year. The production unit at Singapore will add to these production capacities, which should total, by year-end 1984, 261 million pieces, with a total of 2,200 employees for this division.

The Bipolar IC Division's five circuit design centers are distributed over three continents: Europe (Castelletto [in Italy], Graffing in the FRG, and Rennes in France), the United States (Phoenix), and Asia (Singapore). Under its development policy, 80 new products are expected to be developed in 1984. Most of its sales are currently in the consumer products sector. In 1982, these represented 66 percent of the company's overall revenue, but will probably not exceed a ratio of 44 percent in 1984 and 32 percent in 1986. This drop in percentage will be owing to the rise in the business products sector (20 percent in 1982, 35 percent in 1984 and 43 percent in 1986). SGS's share of the bipolar circuit market was 2.9 percent in 1983; it is planning to attain 5.3 percent by 1986. The reason for this is that its growth rate is exceeding the industry branch average in all markets. And this in turn is owing to unique technologies, innovative processing of circuits, innovative circuits, and a production apparatus whose renovation is being geared to match the realities of the years ahead.

MOS IC's

The MOS IC Division accounted for 28 percent of the company's revenue in 1983, whereas in 1980 it represented only 15 percent. As a result, SGS rose from 27th to 22nd in the ranking of suppliers of NMOS circuits, and from 20th to 17th in CMOS circuits. Its objective is to chalk up sales in MOS technology totaling $500 million in 1988. To attain this objective, SGS is pushing ahead more and more in the very-high-density integration technologies (2 microns and less) as well as in CMOS technology, and has intensified its efforts to penetrate the U.S. and the Asian and Pacific zone markets. Another spearhead in its advance: Its intention to render operational in the short term its 6-inch-wafer production lines.

Although it is presently out of the question for SGS to develop its own microprocessor, inasmuch as de facto standards already exist on the current market, the company's engineers are concentrating their efforts on the development of innovative peripheral circuits.

Discrete and Standard Logic Circuits

The Discrete and Standard Logic Circuits Division derived 50 percent of its 1983 revenue from power transistors, 32 percent from standard logic circuits, and 18 percent from low-power transistors. The division's spearhead and head office: Catania, Sicily. Between 1980 and 1983, $40 million had to be injected--around half of these investments have generated fallouts to the local economies--to transform the productive apparatus. The fact is that in 1980 the productive plant was operating with a low level of technology and a very high level of manpower. Currently, it is exactly the contrary. In part, this is owing to the high minimum-wage levels imposed by the unions. Attesting this is the fact that at the time of our visit, final adjustments were being made to a multipurpose robot that was to be used for inverting components of all sorts on printed-circuit cards. The results of these investments lost no time whatever in making themselves felt: In 1983, the division's sales climbed by 32 percent. The key factor in all this growth

has been the lowering of costs. This has been achieved in low-production-cost zones, through a rise in productivity, and through the increasingly generalized use (in 70 percent of the production) of plastic packaging.

Systems

The Systems Division is the last and most recent. It accounts for around 5 percent of the company's revenue. The center of its activities is located in Agrate, Italy, in Catania for production and warehousing, in Phoenix for research and development and for support of the American market, and in Geneva where six persons work in the domain of research and development on systems for the development of special applications. Systems are, in effect, the natural continuation of components. Moreover, in this realm of activities, the added value is higher than in the others. The Geneva center is more particularly specialized in 16-bit machines and in operating systems.

Switzerland: A High-Demand Market for High-Density IC's

For Mr Charles Planzo, manager of SGS for Switzerland, our country represents a very interesting market, since the demand is very high for high-density--that is, highly miniaturized--IC's. SGS is working closely with Autophon, in particular, on its wireless telephone, which was introduced for the first time, in the form of a prototype, at the Telecom 83 Exposition in Geneva. The company's gamut of products appears particularly well suited to the needs of our market, which is also a big user of high-power circuits. SGS's growth is being sustained in our country by users such as Landis & Gyr and BBC, in addition to the aforementioned Autophon company.

[End of text; boxed insert follows]:

Major Milestones in the History of SGS

1957 Start of production of semiconductors.

1958 First planar transistor manufactured in Europe and second worldwide.

1965 Start of production of IC's.

1968 First computer MOS chip to be designed in Europe.

1969 Development of Planox process (patented in 1971).

1972 First fully protected linear power IC. Start of mass production of microprocessors.

1975 First monolithic 20-watt hi-fi amplifier.

1977 First planar 800-volt power transistor using the biplanar technology patented by SGS.

1978 First production of N-channel nonvolatile memories.

1979 First commercially available complementary-PNP-technology power-switch transistor.

1980 First switched-mode 70-watt motor-control monolithic circuit. First 16-bit microprocessor in Europe.

1981 First low-cost bipolar IC working on line voltage of 200 V.

1982 First switched-mode 150-watt monolithic regulator.

1983 First microprocessor with nonvolatile RAM.

9399
CSO: 3698/446

MICROELECTRONICS

PHILIPS LABS STUDY NEW OPTICAL STORAGE METHODS

Aarau ELECTRONIQUE in French Sep 84 pp 54-55

[Text] For some time now the Philips laboratories have been studying entirely new methods of storing information, particularly methods involving optoelectronic principles.

One such system consists of a disk the size of a long-playing record, coated with a sensitive material in which a laser beam creates microcavities. During the laser-reading phase, a physical effect is produced which depends on the material and owing to which the information becomes available in coded form. Depending on the nature of the material, it is possible to record either solely digital data (alphanumerical and audio) or video information. The latter will depend on the signal-to-noise ratio, video being far more demanding in this regard, owing to the large number of shades of gray. In addition, the stored information can be erased or not.

The work of the laboratories is currently centered on three categories that appear to be suitable: Tellurium-silicon alloys, optomagnetic alloys and organic compounds. The study of the latter two categories has, practically speaking, not yet progressed beyond the research stage. Tellurium alloys are better known and are already being used, particularly in the digital optic disk of the Megadoc system.

The recording and reading apparatus have characteristics in common, regardless of what support is chosen. In particular, they are designed to work with an infrared laser diode (around 800 nm), the beam from which produces a physical change in the material: The formation of a hole or a change in state of the tellurium-selenium alloy, the formation of a pit in an organic compound, or a change of magnetic orientation in a given zone of an optomagnetic material (In all cases, the diameter is around 1 micron). The laser power needed to record information is around 10 mW (50-nsec pulses); and to read information, for all materials, 0.5 mW.

Tellurium-Selenium Alloys

To this polycrystalline alloy other elements, such as arsenic, have been added in small quantities, permitting better control of the point of fusion,

and of the stability, of the material. A thin layer of this alloy is deposited on a substrate; then, using a very narrow laser beam, a local fusion is produced to form holes of a depth corresponding to the thickess of the layer. During reading, by means of a less intensive laser beam, the presence or absence of pits produces differences of reflection which represent the information in coded form.

Useful-life tests have shown that the storage of information can be guaranteed for a period of at least 10 years, with no particular requirements as to conditions. In an air-conditioned room, the duration of storage is greatly lengthened. Tellurium alloy also makes possible the erasure of the stored information and the recording of new data. By adjusting the output level of the laser beam, local fusion of the polycrystalline material can be produced but without the formation of pits down to the level of the substrate. At the termination of the laser pulse, the melted zones cool so rapidly that they solidify in an amorphous, metastable phase. During reading, light is reflected by these miniscule amorphous zones differently than by the crystalline environment. Erasing is done by a laser beam at an energy level sufficient to restore the amorphous zones to their crystalline phase. As many erasures as necessary can be made. Since the signal-to-noise ratio is good, this process can also be adapted to video recording. The process, however, is still in the transition stage between research and development.

Organic Compounds

There are organic colorants which, even in very thin layers, absorb a great deal of light and have high reflective power. These appear to offer a viable alternative to tellurium-selenium alloys. The difference is that in this case the depth of the microcavities generally does not reach the substrate. The process of fusion is irreversible, so that recording can be done only once on a disk. As regards the usable-life span of recorded information, tests have shown these organic elements to be as stable as tellurium-selenium alloy.

These compounds are also heat- and moisture-resistant. The centrifuging process known as "spin-coating," for the depositing of the organic compound on the disk, is an interesting one owing to its simplicity. The high signal-to-noise ratio obtained experimentally lends itself to the recording of video as well as digital information.

Optomagnetic Materials

Amorphous magnetic gadolinium-iron-cobalt compounds have been known for a relatively long time. It is possible, by means of a laser beam, to heat the material locally, invert the magnetic polarization of the tiny zones thus created, and fix them in that state. It is also possible to register on a magnetized layer a configuration of inverse-magnetic-polarization zones, which can later be read by means of a polarized laser beam. Owing to the Kerr effect, the direction of polarization of the reflected light shifts

slightly with respect to the direction of the incident light (the sense of this angular displacement will depend on the direction of the magnetization).

This permits distinguishing between modified zones and unmodified ones. It is also possible to erase the stored information. For this, it is sufficient to heat the modified zones by means of a laser beam while exposing the disk to an external magnetic field the direction of which is the same as that of the initial magnetization; these zones, after cooling, recover their initial direction. These operations can be repeated without limit. Given the value of signal-to-noise ratio, this method of recording is not suited to other than digital data (alphanumeric information and digital audio signals). The possibility of improving this signal-to-noise ratio is not precluded, in which case video signals could also be recorded.

9399
CSO: 3698/446

SCIENTIFIC AND INDUSTRIAL POLICY

AID TO INNOVATION FROM FRANCE'S ANVAR IN 1984, BY INDUSTRY

Paris INDUSTRIES & TECHNIQUES in French 20 Feb 85 p 25

[Article: "Aid for Innovation 1984: Fr 870 Million for 1,700 Enterprises]

[Text] In 1984, ANVAR [National Agency for the Implementation of Research] granted Fr 867 million in aid for innovation, compared with Fr 823 million in 1983. This slight increase of about 5 percent must be viewed in the light of the austerity policy. By way of comparison, there was 31 percent growth between 1982 and 1983. Out of 2,100 files registered in 1984, 1,709 were eventually approved, compared with 1,494 in 1983. The numerical growth (14 percent) is significant, therefore, and means that the average amount of assistance diminished slightly. Eighty-seven percent of the files are channeled through the regional delegations, with Ile-de-France and Rhone-Alpes at the top of the list.

Thirteen Grants for the Metal Industry

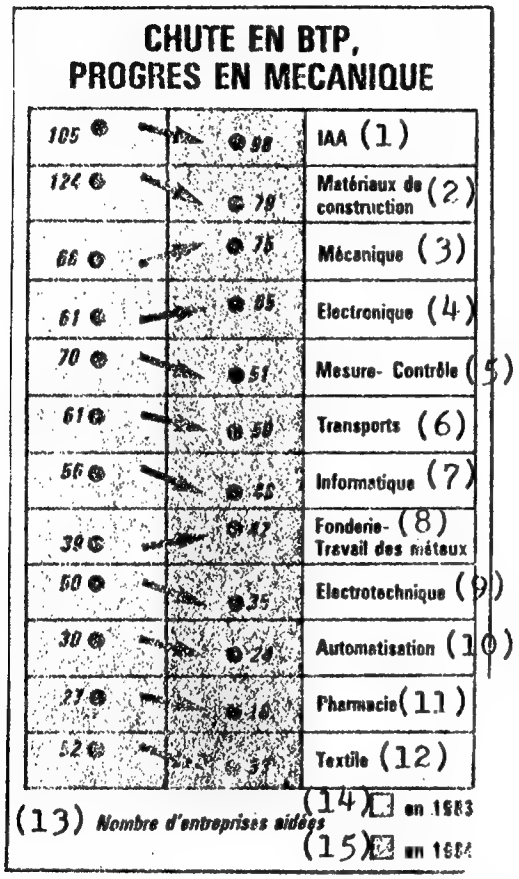
By industrial sector, the number of files approved generally reflects considerable stability. On the other hand, the amounts of the assistance distributed varied greatly in some sectors. Innovation, with its concomitant financial support, showed a marked increase in electronics and automation (+58 percent and + 55 percent), which is hardly surprising. Less expected is the extraordinary spurt for the metal industry, which has incontestably come out the winner for the year, + 195 percent, in the total amount of aid.

The number of innovatory enterprises, however, only reached 39 in 1983 and 42 in 1984. On the other hand, whereas a single grant was made by the agency's office in 1983, it made 13 of them in 1984, of which 2 were very large, for Fr 13 and 10 million (to a naval shipyard and an ironworks) respectively.

The iron and steel industry is the sector which is losing ground. The 12 files of 1984 only represent total assistance of Fr 7.9 million, compared with Fr 33.7 million for 27 files in

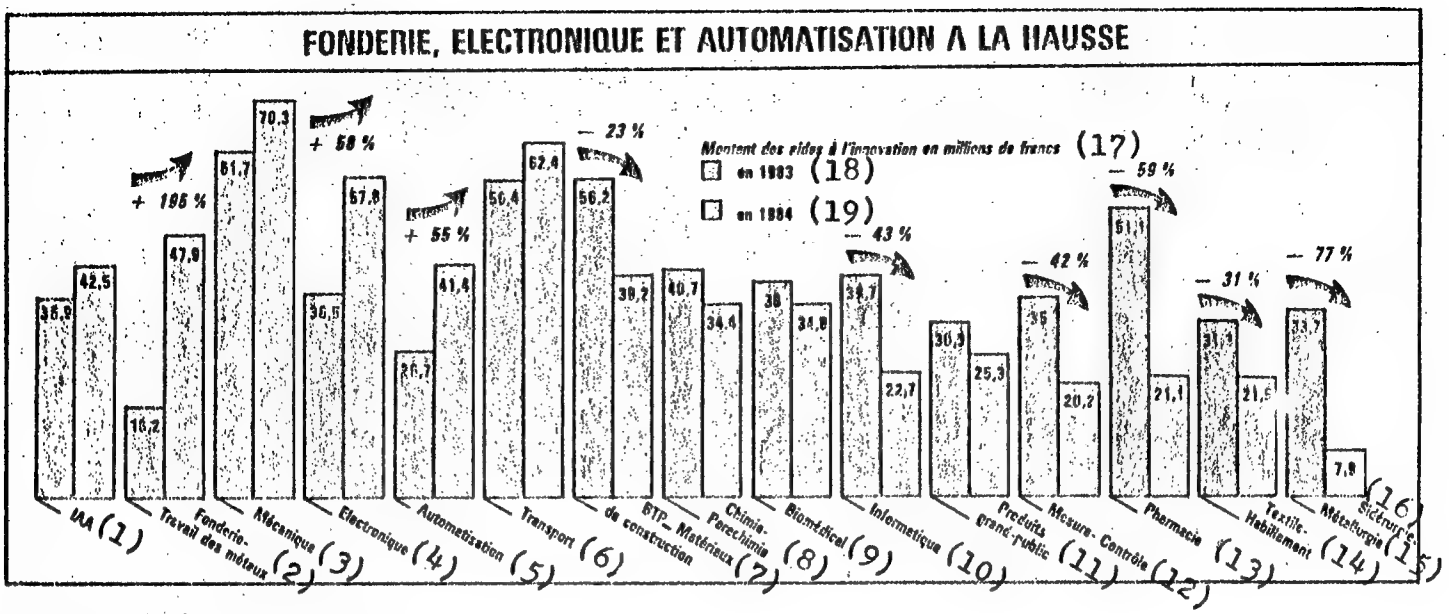
1983. There has been a similar decline in pharmaceuticals, quality control, data processing and BTP-[Public Buildings and Works] construction materials. The last sector, which received 124 grants in 1983, received only 79 in 1984. The situation is perhaps to be explained by the 1983 closing of ANVAR's two calls for contract offers in the area of construction.

Table 1. Decline in BTP, Progress in Engineering



Key:

1. Agricultural and food industries
2. Construction materials
3. Engineering
4. Electronics
5. Quality control
6. Transportation
7. Data processing
8. Smelting, metal industry
9. Electrical engineering
10. Automation
11. Pharmaceuticals
12. Textiles
13. Number of businesses helped
14. In 1983
15. In 1984



INDUSTRIES ET TECHNIQUES 20/02/85

25

Table 2. Smelting, Electronics, and Automation on the Rise

Key: 1. Agricultural and food industries
2. Smelting, metal industry
3. Engineering
4. Electronics
5. Automation
6. Transportation
7. BTP-construction materials
8. Chemical industry, parachemistry
9. Biomedical
10. Data processing
11. General public products
12. Quality control
13. Pharmaceuticals
14. Textiles, clothing
15. Metallurgy
16. Iron and steel
17. Total innovation assistance in millions of francs
18. In 1983
19. In 1984

9824
CSO: 3698/457

SCIENTIFIC AND INDUSTRIAL POLICY

FRANCE ESTABLISHES VENTURE CAPITAL FIRMS ABROAD

Paris L'USINE NOUVELLE TERTIEL in French Mar 85 pp 28, 29

[Article by Marie-Jeanne Pasquette: "French Venture Capital Also Exported"]

[Text] Established in Switzerland, SIPAREX Participation will be the relay point for French venture capital directed throughout the whole world.

France has become too small for its venture capitalists! After SOFINNOVA, Paribas and Indosuez, SIPAREX, the southeast's investment organization, is extending its venture capital activities outside France.

Ten years ago, the French "joint venture capital" market was not ripe. To do business, one had to be set up in California. Nowadays, if venture capital companies choose to establish themselves overseas, it is rather to provide with their own funds French companies that want to penetrate foreign markets.

With this perspective, SIPAREX has just created SIPAREX Participation, an international fund which will soon be established in Switzerland.

Dominique Nouvellet, the managing director of the regional organization, will apply his team's know-how to promote the international development of the 40 businesses in whose capital the firm is already present, with holdings of Fr 102 million.

Funded with 15 million Swiss francs divided among approximately 10 Swiss, American, Belgian, French, and also Kuwaiti shareholders, SIPAREX Participation is expecting its first deposits.

Setting up a fund abroad rather than operating from France offers several advantages.

First, a strong currency like the Swiss franc gives investors confidence. "Without a reduced exchange risk, foreign

participating capital would perhaps not have entered France," Dominique Nouvellet observed.

Then, ventures carried out from Swiss soil also avoid the necessity of going through French foreign exchange control for each capital outflow.

SIPAREX's initiative reflects a growing movement towards internationalization in venture capital. With the exception of SOFINNOVA, which has gained experience in American venture capital since 1974, the overseas organizations of Paribas and Indosuez are more recent.

PARIBAS Technology USA and Japan were established at the beginning of 1982, whereas the Suez Technology Fund (United States) and ISA Development Capital (Southeast Asia) were created in 1984. The latter, based in Hong Kong, will exploit 50 years of the existence of the Indosuez Bank in Asia to promote joint ventures with French companies. Their first operation is already on the drawing board.

Others will follow, and businesses have much to gain from them. Those affiliated with SIPAREX, for example, will profit by them: not only will the fund promote their international development by acquiring holdings in their foreign subsidiaries (Salomon is considering this approach), but above all it provides strong encouragement to the transfer of technology and to cooperation between French and foreign companies. "French leaders hesitate to make joint ventures with foreign partners, because they are afraid of being absorbed. By participating in the capital of the newly created company, we can play the role of a reassuring third partner for the two companies involved," Dominique Nouvellet explained.

At the stage where one has to think "international" to achieve development, French venture capitalists provide a lead.

SIPAREX, which has several times given proof of the appositeness of its investments in French companies, is now exporting its know-how. The World Bank has just asked it to establish the first Portuguese venture capital fund.

9824
CSO: 3698/457

SCIENTIFIC AND INDUSTRIAL POLICY

FRANCE INCREASES FUNDING TO AID INDUSTRIAL RESEARCH

Paris AFP SCIENCES in French 15 May 85 pp 1-2

[Article: "Research: Government Priority for the Next Three Years"]

[Text] Paris--The bill on the "three-year plan for research and technological development" (1986-1988) that was forwarded by Mr Laurent Fabius to the Economic and Social Council on 14 May will mark the president of the Republic and the government's determination to continue to give due priority to research in order to ensure the modernization of the country, Mr Hubert Curien stated the same day.

According to the minister of research and technology, the bill, which will pass at least its first reading at the National Assembly before the end of the spring session, late in June, will provide for an increase in the civilian research and development budget of 4 percent per year in constant francs over the next 3 years (1986-1988) and, taking payment credits into account, a 7.5 percent increase in actual value over 1985, i.e. an increase 3-4 times greater than that of the gross domestic product.

"Considering the austerity of the overall state budget, marked by 3-percent decreases in operating budgets and 15-percent decreases in the program-authorization budgets of the other ministries, the actual value of the research budget, by volume, is therefore much privileged," Mr Curien emphasized several times.

Meeting the requirements of modernization and industrial competition with resources and appropriately distributed efforts, while stressing the necessity of intensifying research in the industrial world, a French weak point, and encouraging the scientific employment policy, such are the major orientations, the major ideas that presided over the development of the policy contained in the bill, Mr Curien said.

To encourage industrial research, and in accordance with the wishes expressed by manufacturers themselves, the government decided to double the amount of research tax credits granted to the industry. They will rise from 25 to 50 percent and the ceiling per manufacturer to FF 5 million. "This will amount to injecting some FF 600-700 million into industrial research, which will be far from insignificant since it will represent 1.5 percent of the civilian research budget... This is not very innovative, but it works and is efficient right away," the minister pointed out.

Another measure designed to privilege the industry: in the next few days, Mr Pierre Beregovoy will submit to the National Assembly a measure to promote the transparency of venture capital, which will complement all the above, Mr Curien added.

Every year, 1,400 researcher and engineer jobs essentially designed for young people oriented toward research will be created under the three-year plan. The plan provides for the recognition of an individual's right to research, which will enable any employee of a company to devote one year to the development of some research. However, accrual of this research leave with training or teaching leaves will not be possible.

Various other measures will also be provided to encourage researchers to get out of their specialized fields, to innovate (creation of host positions for researchers; provisions designed to ensure the mobility of researchers after their doctorate; research under outside contracts for which, according to present custom, the salary received in the industry cannot exceed 115 percent of the salary received in public organizations; etc.).

Every year, an assessment of the research programs will be made and published, both at national level by the Higher Council for Scientific and Technical Research (CSRT) and at regional level: an annual conference of region presidents could be created under the chairmanship of the minister of research.

Mobilization programs will themselves be assessed. Some must be refocussed (biotechnologies), others redefined, and brand new ones must be launched, for instance on new materials.

Taking the three-year plan into account, the share of French research in the gross domestic product should, according to Mr Curien, amount to 2.6 percent in 1988 compared to 2.25 percent at present.

9294
CSO: 3698/476

SCIENTIFIC AND INDUSTRIAL POLICY

FRG R&D FUNDING BY REGION WITH FOCUS ON BERLIN, 1975-1984

Berlin DEUTSCHES INSTITUT FUER WIRTSCHAFTSFORSCHUNG in German Special Issue #142, 1985 pp1-55 plus Annex

[Study by Kurt Hornschild: "Preferential Arrangement for R&D Funding in Berlin"]

/Text/ 1 Problem Definition and Research Procedure

In the past decade Berlin industry lost an above-average number of jobs: While the number of gainfully employed in manufacturing in the economy as a whole declined by 12.2 percent in the study period from 1975 to 1983, the 23.7 decline in employment in the city was almost twice as high. This development inevitably poses the question of the future orientation of the Berlin enterprises. The decline in the number of jobs can be stopped only if the city succeeds in attracting manufacturing of the highest possible quality and able to compete internationally, as well as the related service industries. It is the responsibility of the government to create the general conditions required to achieve this goal. The change in preferential treatment of the manufacturing industry as well as the numerous support measures affecting the structure which have been introduced are intended to facilitate the necessary structural changes in the regional economy.

Very important for the competitiveness of the Berlin economy is the development of the local research potential--both in industry and institutions[1)]--and also the speed with which research results can be translated into practice. The early practical implementation of technological progress creates a competitive edge and is a precondition for maintaining jobs.

Within the framework of his specific project funding programs the Federal Minister for Research and Technology defined key areas where research projects receive public support. These programs are on a federal level, i.e. they also include Berlin. Within the special programs support is given primarily to long-term projects involved in leading-edge industrial research and development which currently carry a high research and development risk. Because of the promising outlook for these research areas as well as the possible practical application of the research projects to be funded these

programs have a high priority in the Berlin economic policy as well. All the more so since the results of the research projects are to be made widely available so that they will have the the broadest possible impact.

In "standard funding"--in addition there are funding models "projects close to the market" and "exclusive use"--the companies must permit the government as well as other companies access to the research results, with the degree of access dependent on the amount of funding and not being unduly detrimental to the company's own justified interest in the practical application of the results. Generally, the grant recipients themselves should contribute 50 percent of the funds; in exceptional cases grants covering 100 percent of costs are possible. Berlin companies are granted an additional 10 percent bonus--a bonus which is also given in connection with several other programs to stimulate the economy (ERP [European Recovery Program]-funds). However, more recent programs such as microelectronics and manufacturing technology do not include the Berlin bonus.

Within the scope of this study the significance of specific project funding of the BMFT [Federal Ministry for Research and Technology] for the Berlin economy is to be analyzed and its effects are to be evaluated with the study focusing on three areas:

--First the question has to be answered as to which firms and institutes have received funding so far. A differentiated analysis of the BMFT funding statistics will give some preliminary insight into the importance of these programs.

--Secondly, the stimulative effects of the funding should be examined; this part of the study centers on enterprises in commerce and industry. A survey of companies provides the necessary information such as conditions in Berlin as a location for research and development activities in private industry, the stimulative effect of the 10 percent bonus, translation of research findings into production.

--The statistical analysis of data as well as the results obtained from the surveys will provide the basis for the third part of the study, an evaluation of BMFT project funding in Berlin including regional comparisons. The funding itself will be evaluated with special consideration of the 10 percent Berlin bonus; it will also be considered in the context of other support measures.

2. Analysis of BMFT Funding Statistics

2.1 Problem Definition

From 1975 to 1983 the BMFT made available a total of DM 24.3 billion for direct project funding. Of the 3.3 billion marks awarded in 1983 commerce and industry received 2.9 billion marks. Thus, according to the latest figures direct BMFT project funding accounted for 75 percent of the total R&D support for commerce and industry nationwide[2)].

"Project funding is concentrated in areas where the market mechanisms are not yet operational, i.e. in areas

- where the government has specific responsibilities,

- with long-term and risky projects and

- for demonstration projects to prove the technical and economic feasibility of a new technology"[3].

Although there is presently a shift towards indirect or indirect-specific funding [4], in the more immediate future direct project funding will continue to be of central importance within R&D funding as a whole in terms of the average amount of funding.

BMFT funding of innovation and R&D is nationwide, and this is true both of direct and indirect-specific funding and the special programs "Microelectronics" and "Manufacturing Technology". With the exception of Berlin, regional interests are not taken into consideration. However, this is not meant at all to indicate that funding is neutral in terms of regions. On the contrary: due to the different economic structures certain regions can be expected to receive a major portion of the funds.

In view of the key role project funding plays as part of the overall funding for innovation and R&D, an analysis of its regional effects seems to be particularly urgent. The evaluation of BMFT funding statistics will provide first indications as to the extent to which Berlin has participated in BMFT project funding compared to other federal states and who in the city received BMFT project funding. While other factors have to be considered as well, in the final analysis the decision whether and to what extent measures will have to be taken to balance funding among the various regions depends also on the degree to which the support funds are unevenly distributed now.

2.2. Funding Distribution

As was expected, the federal states of North Rhine-Westphalia, Baden-Wurttemberg und Bavaria receive the largest share of BMFT specific project funding. These states received 35 percent, 19 percent and 18 percent respectively of the funds which have been awarded since 1975. Berlin is in seventh place with 3.4 percent, still ahead of Schleswig-Holstein (2.5 percent) and the Saarland (2.2 percent). At the bottom of the list are Bremen (1.7 percent) followed by Rhineland-Palatinate whose share is only .8 percent (see table 1).

The time study shows that initially the Berlin share had increased from two percent (1975) to a respectable 4.7 percent (1981). This, however, was followed by an abrupt decline to 2.4 percent; most recently it stood at 3 percent (see table 2). Thus, the amounts of BMFT funding for Berlin correspond to the other economic characteristics of the city: 3.6 percent of the gross domestic product produced by the national economy is generated in Berlin, 3.4 percent of the gainfully employed work in the city (see table 3).

A detailed analysis of BMFT funding statistics by programs and recipients shows that regional participation in the individual programs as well as the types of recipients vary greatly.

Of the 19 special programs, the support for "Energy Research and Energy Technology" (item 07) and "Information Technologies" (item 08) must be emphasized in particular. However, while the amount of funding awarded to energy research fluctuated during the whole period covered by the study--it varied between 39.2 percent and 53.6 percent--for "Information Technologies" it decreased from 21.7 percent (1975) to 7.9 percent (1983). This reduced percentage is not offset by a corresponding increase in another program. Rather, a number of areas made up for the loss (see table 4).

Of greater importance still are "Transportation and Traffic Technology" (item 14), "Space Research and Space Technology" (item 13) as well as "Research and Technologies for Securing Raw Materials" (item 05), most recently with shares of 7.4 percent, 6.8 percent and 5.5 percent respectively.

Until most recently, the program "Information Technologies" was of central importance for Berlin. In 1975, almost half of the funds received by the city through BMFT project funding came from this program category. The time study shows that initially Berlin was able to expand its share in total information technology funding continuously from 4.4 percent (1975) to as high as 21.2 percent (1981). Then, 1982 showed a strong decline: the Berlin share declined to approximately 10 percent and remained at this level in the following year. Berlin's drastically reduced share in BMFT project funding in 1982 is not least a consequence of this development (see table 2).

However, these percentages--some of which are very high--must not hide the fact that these are programs of minor significance compared to the total amount of funding. With the exception of "Humanization of the Work Life" (item 02) und "R&D Serving Health" (item 06)--2.8 percent--each of these programs received less than 2 percent of the total average amount (table 4).

As already mentioned, an evaluation of the regional significance of BMFT project funding must include the recipients as well as the amount of funding. Universities, scientific institutions as well as private enterprises receive BMFT project funding. With regard to the regional impact, an examination of the question to what extent commerce and industry in Berlin profit from BMFT project funding is particularly important. In this context, a difference has to be made between manufacturing on the one hand and the other economic areas on the other hand. The BMFT statistics are subdivided, for instance, into agriculture and fishing industry, energy supply, mining, construction trade, commerce, transportation, credit and financing institutions, independent scientists, the health field, business consulting, architecture and engineering offices, automatic data processing and other private services.

A comparison between the different types of recipients in Berlin and those in the other federal states on the one hand and between those in Berlin and the Federal Republic as a whole on the other hand shows significant differences. In Berlin, the strong concentration of funds in institutions is striking, while the funding for commerce and industry is mostly below average: In

manufacturing, Berlin received 1.1 percent of BMFT project funding, a figure which is clearly below the corresponding weighted manufacturing or job figures (see tables 3, 6). Even this cursory analysis indicates a specific characteristic of the Berlin economic structure: in the science field Berlin has a highly developed infrastructure, however, there are no corresponding activities in the private economy, in particular in industry.

For further clarification BMFT funding statistics for the five most important programs--"Energy Research and Energy Technologies", "Information Technologies", "Transport and Traffic Technology", "Space Research and Technology" as well as "Research and Technologies for Securing Raw Materials" will be analyzed.

--Energy Research and Energy Technologies

In the study period from 1975 to 1983 the BMFT awarded a total of DM 10.9 marks for energy research. The main recipient of this program--45 percent of BMFT project funding is directed toward energy research--was the manufacturing sector which received three fifth of the funds provided. Energy supply was in second place with a share of approximately one sixth. Institutions received only 11 percent of funds awarded.

Berlin's .9 percent share is extremely low; also, the funds are distributed quite differently: 61 percent of funding went to scientific research institutions and universities, 30 percent to manufacturing companies. Only in Hamburg (27.6 percent)--here, energy supply (63 percent) is the most important recipient-- and in the Saarland (0 percent) are the manufacturing shares lower than in Berlin. Thus, the manufacturing industry in Berlin receives only .3 percent of total funding in this project area which is funded with the highest average average amounts (table 6).

(1)

Direkte BMFT-Projektförderung nach Wirtschaftsbereichen in den Bundesländern im Zeitraum 1975 – 1983

(1) Wirtschaftszweig	(2) Insgesamt	(3) Schleswig-Holstein	(4) Hamburg	(5) Nieder-sachsen	(6) Bremen	(7) Nordrhein-Westfalen	(8) Hessen	(9) Rheinland-Pfalz	(10) Baden-Württemberg	(11) Bayern	(12) Saarland	(13) Berlin (W)
	- in 1000 DM -											
(14) Gewerbliche Wirtschaft	18084085	483194	595434	844222	335628	6859268	1158938	89942	3382104	3643433	457072	234850
(15) davon:												
(16) Landwirtschaft	1278	-	841	274	-	-	-	-	163	-	-	-
Energiewirtschaft (17)	2536017	107	69689	138658	-	1788512	72888	326	24450	106232	330010	5145
(18) Verarbeitendes Gewerbe	13391823	448697	321334	611642	241582	4629857	902616	81285	2827242	3152779	27864	146925
Baugewerbe (19)	162984	-	49027	38559	-	27814	7758	1853	21754	15938	-	281
(20) Handel	7635	-	-	-	-	792	209	-	4490	1959	-	185
Verkehr u. Nachrichten-übermittlung (21)	399106	204	31198	30140	81422	18164	21801	-	9340	137824	-	9013
(22) Versicherungen	35133	-	-	-	-	-	33641	-	-	1492	-	-
Sonst. Dienstleistungen (23)	1610109	34186	123545	24949	12624	394129	120025	6478	494665	227209	99198	73301
Institutioneller Bereich (24)	4302748	119523	241181	703867	65195	1675242	359686	109960	1267897	815616	79255	595326
(25) davon:												
Wiss. Forschungs-einrichtungen (26)	2600904	51713	13815	117503	8003	797902	268458	7014	641063	398032	42604	254797
(27) Staat	3631844	67810	227366	586364	57192	877340	291228	102946	626834	417584	36651	340529
darunter: (28)												
(29) Hochschulen	2358476	40264	125230	244584	14726	649017	232088	68630	484845	291662	36565	170865
Insgesamt (30)	24316833	602717	836615	1548089	400823	8534510	1718624	199902	4650001	4459049	536327	830176
	- in v.H. - (31)											
(32) Gewerbliche Wirtschaft	74,4	80,2	71,2	54,5	83,7	80,4	67,4	45,0	72,7	81,7	85,2	28,3
(33) davon:												
Landwirtschaft (34)	0,0	-	0,1	0,0	-	-	-	-	0,0	-	-	-
(35) Energiewirtschaft	10,4	0,0	8,3	9,0	-	21,0	4,2	0,2	0,5	2,4	61,5	0,6
Verarbeitendes Gewerbe (36)	55,1	74,5	38,4	39,5	60,3	54,3	52,5	40,7	60,8	70,7	5,2	17,7
(37) Baugewerbe	0,7	-	5,9	2,5	-	0,3	0,4	0,9	0,5	0,4	-	0,0
Handel (38)	0,0	-	-	-	-	0,0	0,0	-	0,1	0,0	-	0,0
(39) Verkehr u. Nachrichten-übermittlung	1,4	0,0	3,7	1,9	20,3	0,2	1,3	-	0,2	3,1	-	1,1
Versicherungen (40)	0,2	-	-	-	-	-	2,0	-	-	0,0	-	-
(41) Sonst. Dienstleistungen	6,6	5,7	14,8	1,6	3,1	4,6	7,0	3,2	10,6	5,1	18,5	8,9
Institutioneller Bereich (42)	25,6	19,8	28,8	45,5	16,3	19,6	32,6	55,0	27,3	18,3	14,8	71,7
(43) davon:												
Wiss. Forschungs-einrichtungen (44)	10,7	8,6	1,6	7,6	2,0	9,3	15,6	3,5	13,8	8,9	8,0	30,7
(45) Staat	14,9	11,2	27,2	37,9	14,3	10,3	17,0	51,5	13,5	9,4	6,8	41,0
darunter: (46)												
(47) Hochschulen	9,7	6,7	15,0	15,8	3,7	7,6	13,5	34,3	10,4	6,5	6,8	20,6
Insgesamt (48)	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0

Quellen: BMFT; DIW. (49)

Direct BMFT Project Funding According to Economic Sectors

in the Federal States

For the Period 1975 to 1983

1. Economic Sector
2. Total
3. Schleswig Holstein
4. Hamburg
5. Lower Saxony
6. Bremen
7. North-Rhine Westphalia
8. Hesse
9. Rhineland-Palatinate
10. Baden Wurttemberg
11. Bavaria

12. Saarland
13. Berlin (West)

14. Commerce and Industry
15. divided into:
16. Agriculture
17. Energy Industry
18. Manufacturing
19. Construction
20. Trade
21. Traffic and Data Communication
22. Insurances
23. Other Services

24. Institutions
25. divided into
26. Scientific Research Institutes
27. Government
28. including:
29. Universities
30. Total

31. as a percentage
32. Commerce and Industry
33. divided into:
34. Agriculture
35. Energy Industry
36. Manufacturing
37. Construction
38. Trade
39. Traffic and Data Communication
40. Insurances
41. Other Services

42. Institutions
43. divided into
44. Scientific Research Institutes
45. Government
46. including:
47. Universities
48. Total
49. Sources: BMFT; DIW.

--Information Technology

In the study period the BMFT spent approximately DM 3 billion in support of information technologies--12.4 percent of total BMFT project funding. Almost 60 percent or DM 1.9 billion go to the manufacturing sector.

Berlin received 10 percent (DM .3 billion marks) of total funding for this program; here, too, the 12 percent share of the manufacturing sector is lower than the corresponding national figure. In terms of funding for the manufacturing sector as a whole Berlin's share amounts to 1.3 percent (see table 6).

--Transport and Traffic Technology

In the period from 1975 to 1983 funding for transport and traffic technology amounted to a total of DM 1.9 billion or 7.9 percent of total funding, with Berlin receiving 6 percent.

An analysis of who received funding illustrates again the specific regional structure: of the DM .1 billion given to Berlin 60 percent were used in the non-industrial economy, manufacturing received only DM 19 million just one percent of the total funds allocated to this economic sector.

--Space Research and Technology

This is an area which also comprises a large amount of military research. Due to its special political status Berlin has only limited eligibility: Allied regulations prohibit military research and development as well as the production of military goods in the city. Therefore, Berlin's low share of .9 percent in this important funding program--almost DM 1.5 billion have been allocated so far--comes as no surprise. The concentration of funding in institutions (99 percent) is also a logical consequence.

--Research and Technologies for Securing Raw Materials

In terms of funds spent in the study period (DM 1.2 billion) this program takes fifth place in BMFT funding; it accounted for five percent of funding.

Berlin's participation in this program was below average. This is true both of the general regional economy--in the study period the share was two percent--and the manufacturing sector. In this economic area Berlin received DM .7 million or .1 percent of the corresponding total funds (see table 6).

In summary: The subsidies which Berlin received from BMFT project funding are in line with the city's contribution to the overall economic output. An analysis of programs and recipients shows great differences from the national average both in the use of programs and recipient structures:

In three of the five largest special programs the city's participation is below average compared to its economic output. This is contrasted by a number of programs where Berlin receives a large percentage of funds. Considering the highly project-specific subsidies such as BMFT project funding and the different regional economic and industry structures such a result does not come as a surprise. However, this fact alone illustrates the extent to which BMFT project funding results in different subsidies for different regions--by being limited to specific technical areas and thus consolidating already existing structures.

Commerce and industry in Berlin receive markedly fewer funds than they would be entitled to considering their respective contributions to the overall economic output. Considering that the general conditions in Berlin are favorable, from the city's perspective this result is unsatisfactory for several reasons: Berlin is an area of economic concentration and a diverse economic structure. Research-intensive industries such as electrical engineering, mechanical engineering and chemistry are not only represented here, but are also of relatively great importance in industrial manufacturing. In addition, there is a well-developed scientific infrastructure which is evidenced by the large influx of subsidies from BMFT funding and is confirmed by business people.

2.2.1 BMFT Project Funding for Commerce and Industry in Berlin

We will now discuss in some more detail why commerce and industry in Berlin make relatively little use of BMFT project subsidies. An answer to this question is of particular interest since with a generally declining population and the related decrease in demand, job losses can only be offset by increased sales to areas outside Berlin. Therefore, this applies in particular to the Berlin industry and to services catering to areas outside Berlin.

To be sure, BMFT project funding also creates or maintains jobs in the public sector. However, it is not possible to compare these site-selection processes with the decision-making processes in private industry: while site selection in the public sector is more or less the result of politically motivated planning, in private industry general economic conditions, i.e. the attractiveness of the location, are far more important.

In the study period from 1975 to 1983 the BMFT approved a total of 237 projects for commerce and industry in Berlin. The research projects are divided among 92 enterprises; subsidies totalling DM 284 million having been awarded so far. These figures could lead one to assume that these subsidies have a broad impact--an assumption which upon closer analysis turns out not to be true, at least not for Berlin: only six companies received half of all subsidies; only three of these with a share of 28 percent are manufacturing companies. In addition, not all projects applied for from Berlin or statistically assigned to Berlin by the BMFT are actually carried out here. In one larger company which is one of the major applicants not even 10 percent of BMFT project funding was used here.

Even if we take into consideration reverse effects, i.e. a company in West Germany applies for funding and carries out the project in Berlin, based on a great deal of information it can be assumed the Berlin's share in the BMFT funding is probably smaller than the figure calculated from the funding statistics.

But even if we accept the official statistics, a look at the use of BMFT project funding shows a sad picture for the Berlin industry: of the 92 enterprises in commerce and industry only 59 are in manufacturing, 27 are in the service industries, the remainder is distributed among the energy, transportation, construction and trade sectors. Manufacturing companies in Berlin received subsidies totalling DM 147 million which amounts to only 1.1

percent of the funds made available by the BMFT for this area. Only the federal states of Rhineland-Palatinate (.6 percent) and Bremen (.2 percent) received a lower percentage (see table 5).

To be sure, the Berlin industry cannot be expected to take a top position among the federal states with regard to BMFT project funding. Such positions are reserved for the states of North Rhine-Westphalia (34.6 percent), Bavaria (23.5 percent) and Baden-Wurttemberg (21.1 percent). It is, however, disappointing that the percentage share of the regional industry in BMFT project funding is not even equal to its contribution to the output of the national economy (3.4 percent).

When discussing the below-average participation of the Berlin industry compared to its output one must not overlook the fact that in some special programs the Berlin industry is more heavily represented. This is true in particular of "Information and Documentation" (item 12) and "Cross-sectional Activities" (item 00) where Berlin receives 16.7 and 16.4 percent respectively. The programs "Biotechnology" (8.6 percent, item 04), "Humanization of the Work Life" (4.9 percent, item 02), "Manufacturing Technology" (4.8 percent, item 11) and "R&D Serving Health" (4.7 percent, item 06) should also be mentioned here (see table 5).

One reason for Berlin's poor performance could be the size of the companies. BMFT subisides are geared primarily to larger companies. Due to the extensive application and implementation procedures they are less suited for small firms.

Regional comparisons between company sizes show, however, that in Berlin 2.3 percent of all companies and employees are engaged in manufacturing. Likewise, there are only small deviations from the average in the categories for different numbers of employees: companies in the category "less than 20 employees" and "200 to less than 500 employees" have a below-average representation with 1.2 and 2.1 percent respectively. On the other hand, they are slightly above average in the categories "20 to less than 50 employees" (2.7 percent) and "50 to less than 100 employees" (2.5 percent) as well as "more than 1,000 employees" (2.6 percent) (see tables 7 and 8).

A look at the types of industries may further explain why industry in Berlin makes relatively little use of BMFT project funding. As already mentioned, Berlin has a relatively balanced economic structure. In this context, the DIW [German Institute for Economic Research] noted:[5] "The assumption that the R&D lag in Berlin is due primarily to an unfavorable regional industry structure--e.g. aircraft and space technologies with their intensive research activities are absent--cannot be confirmed by an analysis of the individual industrial branches: in almost all areas the R&D intensity is lower in Berlin than in the West German industry, and this applies both to sales and personnel. The two large Berlin industrial branches, electrical engineering and mechanical engineering in particular, lag behind the national figures." The lack of commitment on the part of the companies, which are potential applicants for BMFT funding, is also considered unfortunate: "Top management of large companies is not located in the city. Consequently, there are also relatively few secondary, dispositive areas. Although large companies continue to have

research departments or research projects in the city, their activities are nevertheless less than in other prominent locations. Above-average R&D activities exist only in chemistry, an industry which is dominated by the only large company in Berlin".

Even if research and development activities can be used only to a very limited extent as a measure for the future technological orientation of the regional economy--company-owned manufacturing plants can have state-of-the-art technology for their products and production without their own research and development--the presence of research and development departments is

nevertheless very important for the city for several reasons. Compared to manufacturing, jobs in R&D have the advantage that they

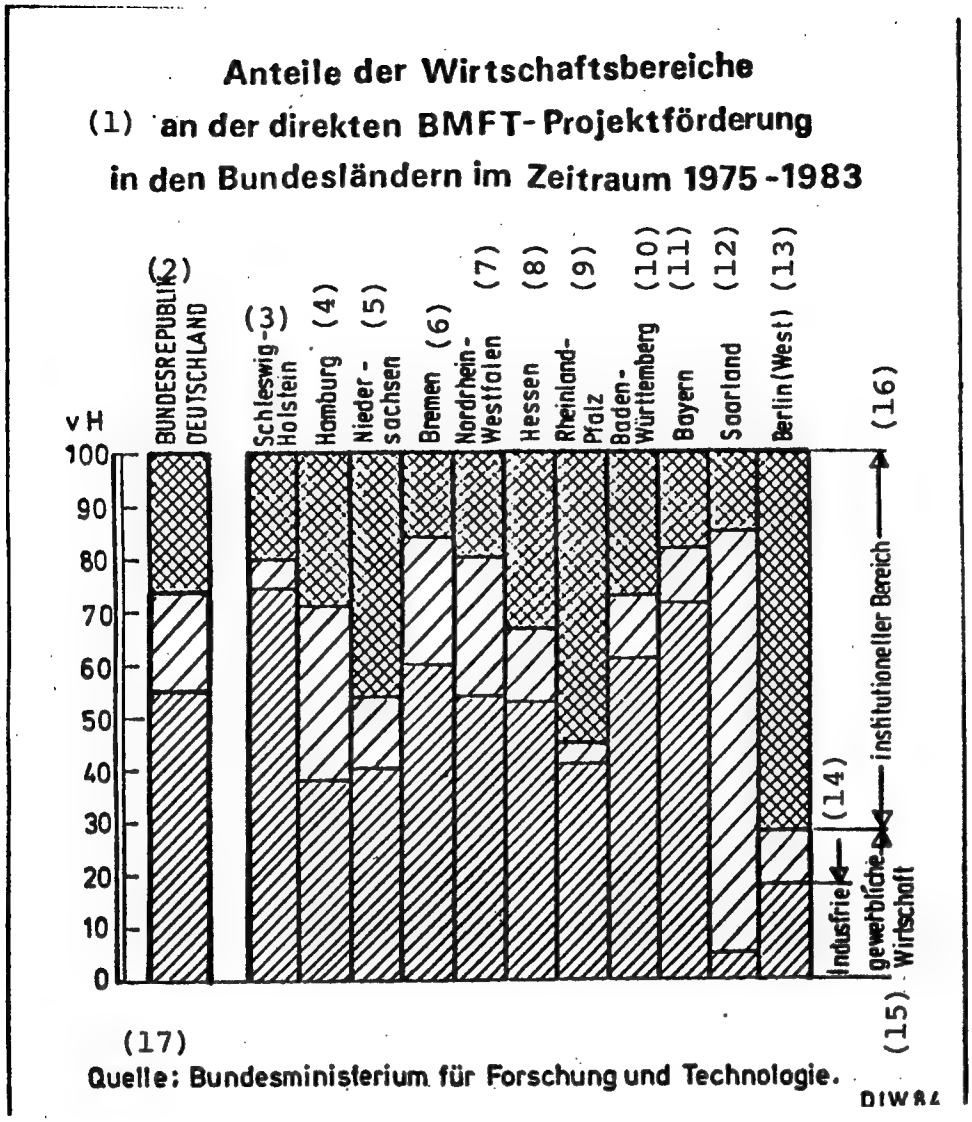
--require personnel with above-average qualifications

--are generally labor intensive and not harmful to the environment

--use relatively little industrial or commercial space.

The efforts to make Berlin a research center in Germany succeeded in the non-industrial area. As the research data so far indicate there is no equivalent in private industry. In view of increasingly labor-saving production methods the future of the city will depend very much on how successful it will be in creating more R&D jobs in private industry as well. The universities with their educational capacities should provide favorable conditions in this respect. However, it is also the responsibility of the government to accelerate this process by using its economic policy to create appropriate conditions.

The DIW surveyed Berlin enterprises on these questions to find out what importance the private sector attaches to BMFT project funding and which role this funding plays or could play in the concept of regional R&D and innovation support.



1. Percentages Shares of the Economic Areas in Direct BMFT Project Support in the Federal States from 1975-1983
2. Federal Republic of Germany
3. Schleswig Holstein
4. Hamburg
5. Lower Saxony
6. Bremen
7. North Rhine-Westphalia
8. Hesse
9. Rhineland-Palatinate
10. Baden-Wurttemberg
11. Bavaria
12. Saarland
13. Berlin (West)
14. Industry
15. Commerce
16. Institutions
17. Source: Federal Ministry for Research and Technology

3. Survey of Commerce and Industry regarding BMFT Project Funding

3.1 Concept

The survey covered all Berlin enterpises which received funds through the BMFT project subsidies in the period from 1-1-1975 to 4-30-1984. The BMFT provided the DIW with a list of firms. The list differentiates between recipients of subsidies and the unit that actually implemented the project. The implementing unit was approached, i.e. for some concerns several plants had to be approached.

A total of 92 questionnaires was sent out. Fifty-four firms responded, 30 refused to participate, eight could no longer be found. Some companies had difficulties in selecting the "implementing unit". Some of the projects are carried out in several plants, and as a consequence they cannot be assigned to certain regions, much less to specific plants; therefore there were no responses. To substantiate the information 25 longer telephone interviews and personal talks with local innovation consultants were held.

The survey had several goals. One of them was to find out how BMFT project funding in Berlin stimulates R&D activities, another one to identify problems companies had or have with the subsidies. Another goal was to determine the relative importance of BMFT subsidies among measures promoting innovation in general and to find clues regarding their regional impact.

3.2 Results

A look through the list of funding recipients confirms what we already found: commerce and industry in Berlin take very little advantage of BMFT project funding. And this is true even though the category "commerce and industry" includes the Products Test Foundation as well as the test and training institutes for brewery and alcohol production--the latter receive more than one fourth of the subsidies allocated for Berlin companies in the technical program "Biotechnology"--and the City Works for Energy Supply and Traffic. The Berlin transportation services alone were funded with DM 26 million nine percent of the funds made available to commerce and industry in the city in the study period.

In this context, the AWFI--the Research Institute for Ergonomics--deserves special mention. It is included in the private sector here, since it recently adopted the legal status of a GmbH [limited liability company]; previously--at the time when the projects listed in the BMFT statistics were approved--it was a membership association and would have had to be classified under institutions. The BMFT lists the institute as a service organization in the "50 to under 100 employees" category. For its efforts to humanize the work life it received DM 15.2 million from the corresponding BMFT special program, a respectable five percent of all funds given to commerce and industry.

These examples as well as the fact that not all funds appropriated for Berlin enterprises were used exclusively for projects in this region show that commerce and industry take even less advantage of BMFT project funding than was to be expected from the global analysis of the BMFT statistics.

As to the individual findings:

Of the 54 companies that responded 23 state that the research activities led to patent or license applications, 31 companies said that they did not.

Forty-seven companies stated that the research activities were implemented in production. Of those, companies stating that the research activities

--have already led to production:

--both within and outside Berlin: 32

--in Berlin only: 27

--outside Berlin only: 6

--will lead to production:

--both within and outside Berlin: 38

--in Berlin only: 27

--outside Berlin only: 11

Even when considering that this analysis is company-specific and not project-specific--some companies received several subsidies--and with all due reservations the result must be considered a satisfactory one: after all 87 percent of funded firms converted the research results in the city into production or plan to do so.

The majority of firms is satisfied with the subsidies: a full 51 of them would use them again, only two said that they would rather do without government funding in the future. Seven companies state that in similar situations they would now more thoroughly investigate other funding possibilities and use alternate funding if possible. In this context, reference is made to the program "R&D in Berlin". As confirmed in many conversations this program is much less bureaucratic, the approval periods are shorter and it has the additional advantage of being monitored locally in Berlin.

When interpreting these results one must take into consideration that the companies surveyed were all successful in obtaining funding. A few companies, in particular large firms with several research projects, are already experienced in handling subsidies. Therefore one cannot yet conclude from these results that the subsidies are actually easily manageable.

However, the companies surveyed were also critical: one fifth of the companies said that the subsidies have severe faults. Only small and medium-sized firms had problems with the application and implementation, large companies do not attach great significance to these defects; on the contrary, they state that in general BMFT project funding handles the problems adequately.

The criticism centers around the long and costly preliminary phase and the extensive reporting and control requirements. To meet the requirements the companies need an administrative machinery, and generally only larger firms are able to handle this without problems. Even if the criticism voiced is based on individual experience and must be evaluated accordingly, the unanimous criticism must nevertheless lead to the conclusion that BMFT project funding favors predominantly larger firms: apart from the administrative difficulties, the subsidies make it easier for them to do research for future, not immediate use. Smaller and medium-sized firms will start research projects only if the results can be marketed. In such cases it is extremely restricting to have to go through a long application and preliminary period--combined with the uncertainty of receiving funding--and to have to tie up personnel resources due to extensive reporting requirements.

As already indicated on page 2, the BMFT grants a 10 percent bonus for projects carried out in Berlin. The complex of questions I 7, 8, 9 was intended to obtain statements regarding the impact of BMFT funding. The first question addressed the basic effect of the subsidies (question I 7):

BMFT funding

--made (an) otherwise unfeasible project(s) possible

--considerably facilitated financing.

The responses were divided equally between the two options. Fifty-one percent stated that it was the funding which made the project(s) possible, 49 percent consider the subsidies more of a financing aid. It is not surprising that the subsidies have a considerably greater impact on smaller firms. To them, expensive research projects mean a high risk, failures can quickly become a threat to their existence: of the firms with less than 1,000 employees almost 60 percent depended on the subsidies for carrying out their research; with larger companies, the figures was 40 percent.

Questions I 8 and I 9 were intended to capture possible reactions to a change in funding requirements. Question I 8 tried to find out to what extent enterprises could intensify their research activities with increased funding:

How would your company react to a 10 percent increase in funding? The research activities would

--be intensified

--remain unchanged.

Question I 9 tried to find out to what extent the enterprises depend on funding for conducting their research and what importance they attach to bureaucratic requirements:

Based on your experience with BMFT funding so far would you possibly prefer a 20 percent reduction in funding compared to present levels if the requirements would be reduced at the same time?

--This depends on how they would be simplified

--I can't imagine that.

The analysis of the responses did not yield a uniform picture. Forty-three percent would intensify their research activities if funding were increased. In this context, there is no relationship to the size of the firm. However, the reasons may differ:

While in small firms the research activities are determined within narrow limits by the market and the company structure, i.e. an increase in funding would only make financing easier, in large companies increased funding, e.g. by 10 percent, might be considered too small to cause a reaction.

The range of responses to question I 9 reflects the criticism of the manageability of BMFT project funding. Forty percent of the companies--this percentage shows a declining trend with increasing company size--would prefer reduced funding if at the same time the subsidies could be administered more easily.

When interpreting the responses--and this also applies to response I 8: "Possibility to do more research in general", "Reaction to financial incentives"--two primary influencing factors must be considered: the amount of funding provided and the difficulties the company has in administering the subsidies. If one adheres to the theory that larger companies have more financial resources and can meet the funding requirements more easily, then the fact that still 40 percent of the large companies favor simplified requirements even if funding were reduced can only be taken as an indication that from the companies' point of view BMFT project funding must be improved.

This interpretation could be contradicted by the fact that a relatively high percentage is satisfied with the subsidies--80 percent state that they generally meet their company needs. The fact that all of the companies surveyed here were successful in their application for funding--i.e. despite all difficulties, in the final analysis the result was positive--probably influenced the generally favorable opinion. The amount of funding, which after all covers more than half of the expenses generated, probably was another factor.

The complex of questions II "General information on innovation funding" was intended to collect information on innovation funding in Berlin in general beyond the direct BMFT project subsidies.

In the competition among regions to create new jobs measures stimulating the economy have high priority. This applies in particular to Berlin, a city which attempts to compensate for the disadvantages due to its special location with an extensive support system. The attractiveness of subsidies depends not only on their strictly numerical advantages but also on the positive

perception on the part of the people or firms involved in the region's economy. The question II 1 "How do you judge the innovation funding programs offered for Berlin compared to other federal states?" was intended to test the "funding consciousness" of Berlin companies.

Considering the intensive educational activities and the numerous funding opportunities (--we will come back to that later--) the result is not satisfactory: almost 60 percent of the companies are not able to evaluate innovation funding in Berlin in comparison with other regions. In other words, the majority of companies is not aware of the advantages and disadvantages of funding, which means that they are poorly informed of the specifics of their location. Thirty-nine percent of the companies questioned give innovation funding in Berlin a favorable, four percent an unfavorable rating.

Questions II 3, 4 and 5 tried to find out in which areas in the innovation process the companies are most likely to expect support, which support tools they prefer and which deficiencies in innovation support they consider particularly detrimental.

First the weak points. In response to the question "Which support measures are of particular importance for your company?"

--80 percent listed financial support

--14 percent listed advice in solving technical problems

--six percent listed other support measures such as support in getting highly

qualified personnel, help with bureaucratic requirements and closer cooperation with universities.

The questions "Which measures would be best suited to strengthen the innovative activities in your company?" yielded the following list of preferences:

--Further expansion of project funding	48 percent
--Tax relief	23 percent
--Increased depreciation	11 percent
--Further expansion of indirect funding	10 percent
--Further expansion of the scientific infrastructure	7 percent
--Other:	1 percent

The following deficiencies in government innovation funding were listed:

--too much work	52 percent
--little flexibility	23 percent
--difficult to understand	11 percent
--does not address the problems	5 percent
--distorts competition	4 percent
--other	5 percent

As support measures most companies prefer financial assistance which would allow them as much freedom of action as possible. This was confirmed by their strong preference for tax benefits and depreciation allowances. However, the responses also show that some of the arguments do not take into consideration the actual facts: Berlin has a lower tax burden and more favorable depreciation regulations than any other German region.

Likewise, the high priority given to direct project funding is not surprising. The companies surveyed already have experience with this means of support. With the increased frequency of successful applications the scare of bureaucratic obstacles diminishes, and consequently the benefits derived from the support increase.

A further important aspect is the question of how BMFT project funding affects the employment pattern. Therefore, the companies were asked to list the man-months required for carrying out the BMFT-projects, divided into researchers, technicians and others. Not all companies were able to provide these data. It is particularly difficult for concerns which are listed as applicants but are not the only company in charge of implementing the project. In view of this fact a return of 42 usable responses is very satisfactory.

The 42 companies represent subsidies of more than DM 110 million percent of all subsidies given to all Berlin commercial and industrial concerns. The man-months required for these projects add up to 12,900 with

scientists accounting for 30 percent

technicians accounting for 33 percent

and others accounting for 37 percent.

Thus, support funds of DM 8,600 were required per employee-month. The larger the company, the smaller this amount: among the companies selected here, funding per employee-month for different-size companies is as follows:

20 to less than 200:	DM	20,000
200 to less than 500:	DM	9,500
more than 1,000 employees:	DM	7,600

Projection of these results to commerce and industry in Berlin as a whole shows that BMFT project funding results in approximately 2,700 employee-years.

According to information supplied by the companies, in 50 percent of the cases research activities would not have been possible without BMFT project funding (see page 25). If this is taken into consideration the "net effect" in the study period would be a total of 1,350 persons or an average of 150 persons per year.

The calculation did not include important components such as price developments and personnel costs; extrapolation to commerce and industry as a whole was done globally, the conversion key for determining the net effect on employment could only be a rough estimate. Therefore, this calculation was not able to provide exact figures, however it gives us a first indication as to the extent to which BMFT project funding stimulates employment in commerce and industry in Berlin.

3.3. Summary of the Survey Results

The most important results of the company survey are:

--The percentage of commerce and industry participating in BMFT project funding is probably even smaller than the statistics indicate.

--The projects funded lead to production predominantly in Berlin.

--The BMFT-sponsored projects lead to patent or license applications in more than 40 percent of the firms.

--According to rough estimates employment generated by BMFT funding amounted to approximately 150 persons per year in the study period from 1975 to 1983.

--While funding is critized for the red tape involved in the application process, the majority of companies is nevertheless satisfied with BMFT project funding and would welcome further expansion.

--Many entrepreneurs are not aware of the specifics of their location. Almost 60 percent of those surveyed were not able to evaluate innovation support in Berlin in comparison with other regions.

--Most of the entrepreneurs prefer financial support and would like to retain their freedom of action as much as possible.

--The R&D activities of the companies can be strongly influenced by the amount of government funding: almost every other company surveyed would intensify research activities if funding were increased.

--Given the choice, 60 percent of the companies voted in favor of retaining the current amount of subsidies, 40 percent would prefer a reduction--however only if accompanied by a considerable simplification of the application and implementation procedures.

4. A Few Comments on Innovation Support in Berlin

BMFT project funding can be evaluated only within the framework of all regional measures supporting innovation. The analysis must concentrate on determining the function of BMFT project funding within the Berlin funding structure and on the effects these subsidies will have in the future or which effects can be expected. Since BMFT project funding is an instrument predominantly directed towards larger, already existing concerns, measures targeted more towards the establishment of new firms are largely excluded. The most important subsidies in addition to BMFT project funding are:

Support measures on a national level:

--Subsidies for personnel in research and development

--Special depreciation allowances for investments in R&D

--R&D investment allowance

--Support of contract research

--Special program "Application of Microelectronics"

--Special program "Manufacturing Technology"

--External contract research

--Berlin subsidies:

--Investment allowance (paragraph 19 Berlin Support Law)

--Special depreciation allowances (paragraph 14 Berlin Support Law)

--Support of R&D in smaller and medium-sized firms

--Innovation fund

--Preferential treatment of value added tax

--Assisting innovation.

This study will not describe the objective, structure, volume and use of the individual subsidies in detail. The programs are generally well documented; information of particular interest can be obtained from the program brochures. We will discuss the individual measures only to the extent necessary for our particular subject area.

The support measures--excluding investment and credit subsidies--can be listed under three main headings:

a) Project-specific support:

BMFT special technical programs, R&D in Berlin, contract research, innovation funds, personnel transfer programs.

b) Indirect-specific support:

Special programs "Microelectronics", "Production Technology"

c) Project-independent support:

R&D personnel cost subsidies, investment allowances, special depreciation allowances, preferential sales tax treatment.

a) Project-specific Research

The program "R&D in Berlin" which is limited to Berlin is closest in nature to BMFT project funding. Just like BMFT funding it subsidizes a specific project. The subsidies are granted in the form of outright subsidies (2/3 recipient participation), subsidies with conditional pay-back (1/2 recipient participation) or subsidies which must be paid back (1/3 recipient participation). So far, subsidies totalling almost DM 100 million have been made available.

The conditions are somewhat less favorable compared to BMFT project funding where generally 50 percent of the funding is in the form of outright subsidies, 60 percent in Berlin, and in extreme cases even 100 percent. In addition, this program differs in particular in its objectives and with regard to the group of those qualified to apply. While BMFT funding is aimed primarily at researching new technologies, the Berlin program is intended for industrial innovations in general without setting R&D priorities. While BMFT project funding imposes practically no restrictions, the "R&D in Berlin" program applies only to producing companies with sales of less than DM 150 million or less than 1,000 employees. The company or plant must also be located in Berlin.

The regional program, with its orientation towards small and medium-size firms and not limited to special technical areas, supplements BMFT funding. This, however, is not true for service firms. Some companies which would have used the more manageable Berlin program, but were not eligible as software firms, criticize the fact that only manufacturing firms are eligible to apply. The BMFT-grant statistics also show this gap: a number of firms applied for and received BMFT funding, while the amount of funding and the company size would have made them more suitable for the R&D in Berlin program.

This study did not yield any specific insights into the support programs "Contract Research", "Personnel Transfer" and "Innovation Funds". They are also relatively unimportant for our study area here.

b) Indirect-specific Support

"Between the general strengthening of the R&D potential of the economy on the one hand and the support of very specific problem solutions on the other hand the R&D policy has further tasks, where the work is directed towards a specific research objective but where the company is free to pursue individual solutions to its R&D problems. Here, the indirect-specific support program applies: it is suitable when research and development in important technology areas need support to benefit the economy as a whole. This support should have a wide impact and be limited in time; if possible, it should also be degressive". This is how the BMFT describes the objectives of the indirect-specific project support[6].

Currently, the Federal Government is using indirect-specific support for

--the special program "Expansion of Microelectronics" (the program will run out this year)

--for supporting the use of CAD/CAM and robot development in the manufacturing technology industry (duration 1984 to 1987)

--for the planned special program "Micropheripherals within the Framework of the Information Technology Support Concept" (duration 1985 to 1988).

Experience with indirect-specific project support was gained primarily from the program "Microelectronics" which is currently running out [7]. This program was intended to open new technological opportunities to medium-sized companies in particular; the funds made available for this program amount to DM 450 million.

Geared particularly to medium-sized companies, the application and administrative procedures have been simplified and are considered an indirect measure with regard to funding criteria. Forty percent of the cost of personnel, development contracts to third parties and product-related technical consulation is subsidized. The maximum subsidy per company is DM 800,000 the VDI-TZ [Technology Center of the Association of German Engineers] in Berlin is in charge of the project.

According to the first report by the VDI-TZ on their experience with the program, an above average number of Berlin companies took advantage of this funding program. According to information by the VDI-TZ, the patterns appearing in this report reflect the current status. So far 120 companies in the city received funding.

Special Program

Application of Microelectronics:

Regional Structure of Applicants in Percent
(as of July 1983)

Federal State	Percent of Applicants	Percent of Companies in Manufacturing
Berlin (West)	5.3	2.4
Hamburg	4.7	1.9
Schleswig-Holstein	2.2	3.4
Bremen	1.3	.8
Lower Saxony	7.1	10.1
Hessen	13.0	8.4
North Rhine-Westphalia	20.8	23.6
Rhineland-Palatinate	2.5	6.0
Saarland	.8	1.2
Baden-Wurttemberg	22.8	21.3
Bavaria	18.0	20.7

Source: VDI-Technology Center Berlin

In its 1982 survey of the special program "Microelectronics" the DIW noted a high level of acceptance. Many company executives questioned in this survey regretted the expiration of this funding program. When asked to respond not only for their own company, but to evaluate the economy as a whole, the executives stated almost unanimously that the Berlin economy still had a great need in this area.

The support program "Manufacturing Technology" which just started shows a different picture. This program supports:

--First, developmental work for the in-company application of systems for computer-aided planning, development and design (CAD) as well as planning, disposition and control of the manufacturing process, material flow and inventory management including their integration (CAM). The subsidies cover 40 percent of personnel cost, external cost for consultation, employee training and R&D contracts as well as the cost of technology acquisition, a maximum of DM 400,000 per company.

--Secondly, the development of handling systems with at least three programmable axes and intended for industrial use (industrial robots and operating systems). In contrast to CAD/CAM the maximum subsidy is DM 800,000.

Applications may be submitted by legally independent firms engaged in the manufacture of capital goods. The Nuclear Research Center Karlsruhe GmbH is in charge of the project.

An initial evaluation by regions of how these programs were used shows that--industrial robots and handling systems are heavily concentrated in the federal states of Baden-Wurttemberg and Bavaria which receive 32 and 20 percent respectively or more than half of all subsidies,

-seventy-six percent of CAD/CAM funding goes to the federal states of Baden-Wurttemberg (30 percent), North Rhine-Westphalia (29 percent), Bavaria (17 percent).

Applications for the Program "Manufacturing Technology"
--as of September 1984--

Federal State	Handling Systems Industrial Robots				CAD/CAM			
	Applications		Amount of funding		Applications		Amount of funding	
	No.	%	No.	%	No.	%	No.	%
Baden-Wurttemberg	70	34	31.3	32	468	29	133.5	30
Bavaria	38	19	19.5	20	284	18	73.1	17
Berlin (West)	3	1	1.5	1	20	1	4.6	1
Bremen	2	1	1.0	1	7	-	1.6	-
Hamburg	2	1	1.6	2	32	2	6.9	7
Hesse	28	14	11.6	12	113	7	34.1	8
Lower Saxony	18	9	10.4	11	92	6	25.9	6
North Rhine-Westphalia	32	16	15.6	16	471	29	129.7	29
Rhineland-Palatinate	4	2	1.5	2	61	4	15.1	4
Saarland	5	2	2.2	2	16	1	5.2	1
Schleswig-Holstein	2	1	1.0	1	48	3	10.6	2
Total	204	100	97.2	100	1612	100	440.3	100

Source: Nuclear Research Center Karlsruhe

Berlin's participation in both programs is below average: only four of the total of 1,816 companies which have used the program "Manufacturing Technology" so far are located in Berlin. Three of those applied for funding for the development of industrial robots or handling systems, one company applied for CAD/CAM support. The DM 5.6 million in subsidies given to Berlin constitute one percent.

According to people knowledgeable in the industry the fact that Berlin companies make little use of the "Manufacturing Technology" program is due not so much to the inertia of Berlin companies when it comes to submitting an application, but to the fact that there is indeed very little use of this technology in Berlin.

Thus, the indirect-specific project support can be summarized as follows: While the Berlin economy was able to take advantage of the "Microelectronics"

Thus, the indirect-specific project support can be summarized as follows: While the Berlin economy was able to take advantage of the "Microelectronics" program--aided by the fact that the program-supervising agency was located in Berlin--the stimuli generated by the new programs will largely bypass the city.

c) Project-independent Support

--R&D personnel cost subsidies (PCS)

This program is intended to strengthen the research and development activities of smaller and medium-sized firms [9]. A government resolution extended it to 1988, the average amounts were increased and software developers are now also eligible to submit an application. Further, one program--initated by the BMFT-- is to be added to the PCS, in which smaller firms which are increasing their R&D personnel will receive additional subsidies. Within the framework of the "growth support" 60 percent of gross wages and salaries of newly hired R&D personnel will be subsidized for 15 months. This program does not give any special consideration to Berlin.

--Special depreciation allowances

With the Tax Relief Act of 1984 special depreciation allowances for R&D investments, which were possible until 1974 were reintroduced (paragraph 51, section 1, Income Tax Law). There is a special 40 percent depreciation allowance for movable assets, a 15 or 10 percent rate for immovable assets.

In Berlin, a 75 percent depreciation allowance is generally granted for the acquisition and manufacturing costs of movable assets and real estate (paragraph 14 of the Berlin Support Law). While the reintroduction of the special depreciation allowance for R&D investments does not do away with Berlin's lead in this support area, in comparison with other regions it caused a relative deterioration of Berlin's position in the research and development area.

--Investment subsidies

In the Federal Republic, a tax-free investment subsidy is granted for R&D investments; for acquisitions up to DM 500,000 the rate is 20 percent, for amounts above that 7.5 percent. The rates in Berlin are 40 and 30 percent respectively.

--Preferential treatment of value added tax

The change in the support for Berlin which became effective January 1, 1983 improved the R&D position of manufacturing companies in Berlin. With the additive procedure to determine the value added in Berlin--this amount determines the tax reduction--the subsidies now also take into account R&D expenditures.

From a regional point of view the situation regarding the most important measures to promote R&D and innovation is as follows:

Compared to the Federal Republic--state programs are not included in the study--Berlin receives preferential treatment in

--direct project support: with the 10 percent Berlin bonus granted along with BMFT project subsidies and through the program "Support of R&D in small and medium-sized companies in Berlin" which is initiated by the Ministry of Economics and applies to Berlin only;

--project-independent support: better terms for depreciation and investment allowances, inclusion of R&D personnel costs in the value added figures for Berlin which determine the amount of value added tax reduction.

Despite these advantages the position of the city with regard to federally sponsored R&D and innovation support deteriorated in comparison with the Federal Republic; in the area of indirect-specific support Berlin is treated just like the other regions. It does not have a special status when it comes to project-independent programs; as a matter of fact, the introduction of the special depreciation allowance for R&D investments reduced Berlin's edge due to preferential treatment. In addition, as the research and technology policy is shifted towards indirect-specific and project-independent subsidies, i.e. subsidies without special treatment for Berlin are expanded--the regional economy loses advantages due to preferential treatment in the R&D area.

5. An Evaluation of the Individual Study Results

The rapid technological developments in the product and process area place new demands on the economic and technology policy. This is true of the national economy as a whole and its development in an international context, and also of the individual federal states.

In the past few years, R&D and innovation support has been expanded considerably. In Berlin, the preferential value added tax treatment was changed, i.e. personnel engaged in R&D is now included in the determination of the tax reduction; in addition, through local programs initiatives were taken which are aimed at financing innovation, technology consulting, the establishment of technology-oriented companies and scientific and technological personnel transfer.

Studies of the R&D activities in industry show, however, that despite generally increasing R&D expenditures the commitment of the Berlin firms in this area is only below average: while the manufacturing sector in the Federal Republic spent 3.3 percent of sales for R&D in 1981[10], Berlin spent only 2.4 percent.

Total R&D Expenditures in 1981 in Selected Manufacturing Areas in Berlin and in the Federal Republic as a Percentage of Sales

Industrial Group	Federal Republic	Berlin
Chemicals	4.6	12.3
Mechanical Engineering	3.1	2.4
Electrical Engineering	7.3	6.1
Precision Mechancis, Optics	5.3	3.9
Others	2.3	.2
All	3.3	2.4

Sources: Founder Association for German Science, Essen; DWI.

For this study, the significance of BMFT funding for the Berlin economy had to be researched. The objective was to point out identifiable weak points in the support for innovation in Berlin and--to the extent this is possible in this study--to suggest solutions on how to remove them.

BMFT project funding is a national program which grants a special status to Berlin. The current study does not question the principle of support itself. The stimuli generated by BMFT project funding as well as the effects of the Berlin bonus are analyzed. The subsidies are evaluated by themselves and in connection with other measures.

In terms of volume, BMFT project funding is the most important R&D support in Berlin as well. From 1975 to 1983 commerce and industry in the city received DM 235 million from this program. However, these figures must not hide the fact that only a below-average number of Berlin companies participates in this funding program. From 1975 on, manufacturing in the Federal Republic as a whole received subsidies amounting to DM 13.4 billion. The federal states of North Rhine-Westphalia, Bavaria and Baden-Wurttemberg received particularly favorable treatment; they received 34.6 percent, 23.5 percent and 21.1 percent respectively. That is, 45 percent of these funds went to the econcomic regions Bavaria and Baden-Wurttemberg which have above-average prosperity. Berlin, on the other hand, received only 1.1 percent of the subsidies, which is markedly less than the manufacturing industry of the city would be entitled to relative to its contribution to the gross value added (3.5 percent). Only the federal states of Rhineland-Palatinate and the Saarland are doing worse (see tables 3, 5).

In view of the large amount of subsidies and with a balanced regional structure being the objective of the economic policy, one should at least consider whether future BMFT project funding should not take into account regional needs. While this is done in Berlin, the low Berlin percentage inevitably raises the question of how effective the Berlin bonus is. Although these effects cannot be measured precisely, this study made it nevertheless possible to get some idea regarding its possible effects.

With regard to BMFT project funding it should be noted that it is predominantly larger companies that take advantage of these subsidies. So far, their commitment to R&D in the city has been relatively small. The incentive of 10 percent alone is obviously not enough to effect a basic change in this attitude, i.e. shifting research departments to Berlin.

Thus, BMFT project funding could be an effective tool as part of a regional policy and to improve the economic structure in Berlin only if regional factors would be taken into consideration to a much greater extent than is the case now with the 10 percent Berlin bonus. In this context, it should be checked to what extent funding amounts graduated by region and targeted subsidies limited to certain regions could induce private industry to give greater consideration to less developed regions when they decide on future locations for their R&D activities.

The expanded function of BMFT project funding outlined reaches far beyond the objectives envisioned by the 10 percent Berlin bonus. However, its importance should be determined both independently in an analysis of BMFT project funding and also as part of the various measures to stimulate the economy.

Lately, R&D and innovation support has increased considerably, not only in Berlin, but also in other federal states. According to some experts Berlin's lead in this support area is almost gone. Thus, Berlin would have lost an important argument as a possible location. Federal measures are of particular importance when it comes to efforts to obtain funds: in contrast to regional programs the advantages granted are noticeable immediately and generally.

The 10 percent Berlin bonus must also be viewed in this context. Its availability by itself will not lead to a decision in favor of Berlin, however, it might be the deciding factor in connection with other preferential treatment. From the point of view of Berlin the almost equal treatment of the region in indirect-specific and project-independent support programs is a negative factor; in addition, Berlin's lead based on preferential treatment was reduced by the introduction of the special depreciation allowances for R&D investments.

The fact that many of the entrepreneurs surveyed are not able to compare the Berlin support program with other regions despite the recent strong emphasis on R&D and innovation support is a matter of concern.

As to BMFT specific project funding it should be noted that medium-sized companies which have no experience with subsidies attach less importance to the 10 percent bonus, and more to receiving the actual subsidies. The main reason for this attitude is the relatively complicated application and monitoring procedure for this subsidy. However, the majority of the companies surveyed react most strongly to financial aids and at least every other company wants to increase research activities if BMFT funding is increased by 10 percent--60 percent are not in favor of reducing funding and simultaneously simplifying the application procedure, which means that the Berlin bonus should be judged positively both with regard to its function as a tool in the interregional competition for industrial jobs and to its direct overall effect.

The considerable importance of BMFT funding for Berlin is also reflected in the following company responses: most of the projects sponsored affect production in the city, in more than 40 percent of the companies BMFT sponsored projects lead to patent or licensing agreements. It is estimated that during the study period 150 persons per year are employed in commerce and industry in Berlin as a result of BMFT funding.

In addition to specific project support the company survey also suggested further possibilities for improved regional R&D and innovation support:

Several sources criticize the termination of the program "Application of Microelectronics". Companies and innovation consultants stated unanimously that an extension of this subsidy would have positive effects for a larger number of companies. Closely related is the suggestion for a program to promote the introduction of electronic data processing. It would be the objective of this subsidy to make even more smaller firms familiar with this technology. This would create a situation where companies which have remained uninvolved so far would be able to obtain the basic knowledge required for the application of microelectronics.

The generally positive response to the program "Application of Microelectronics" is due not least to the fact that VDI-TZ, which is in charge of the project, is located in Berlin. This raises the question whether Berlin could not generally be selected as a location for institutions in charge of such programs aimed at small and medium-sized firms. The city with its many scientific institutions offers many opportunities in this respect.

A few subsidies such as R&D personnel cost subsidies and R&D in Berlin apply only to manufacturing companies. This analysis provided some indications which seem to require at least a reevaluation of this restriction. The companies with BMFT project funding include suppliers of services closely related to production which would be better suited for the program "R&D in Berlin" in terms of subsidy amount and size of company. The output of these companies--as a rule they employ personnel with above-average qualifications--is directly related to production and therefore should rather be included in manufacturing and not in service industries. At this time, it is not possible to give an exact answer as to the expansion possibilities for services closely related to production and to what extent the city could profit from this development. The study findings of the task force should provide more detailed information in this respect. However, the greater the possibilities that are expected the more urgent is an answer to the question raised here.

6. Conclusion

While Berlin succeeded in becoming a research center in Germany in the non-industrial area, there is no equivalent in private industry. In view of the increasingly labor-saving production processes the future of the city will depend largely on how well it will succeed in creating more R&D jobs in commerce and industry. However, the city will be able to achieve this goal only if in the future also larger firms will again locate more of their research departments in the city. The right conditions must be created for

this purpose. In addition to confidence in the city as a location this also includes an attractive support system.

In the past few years the federal government as well as the individual federal states expanded their R&D and innovation support considerably. One might sometimes get the impression that competition for jobs had degenerated into an interregional competition between support systems. In this situation, different types of preferential treatment by region in federal programs are particularly effective. Not only do they favor one region over all others, they are also noticeable quickly and generally.

With BMFT direct project funding, the Berlin companies receive a 10 percent bonus. This in itself would not be enough to accelerate R&D activities in the city considerably, however it gives the region a strong argument in presenting itself as a desirable location. The study shows further that this subsidy will lead to intensified R&D activities among Berlin companies as well.

From the point of view of Berlin it would be desirable if the city would be granted privileges in other central subsidy programs by the federal government. This would be particularly helpful in persuading companies to chose Berlin as their loation and could also help make local companies more aware of the specific advantages of their location. Such privileges need not only be financial. Having a local institution in charge, as is the case with the VDI-TZ for the "Application of Microelectronics" program can be particularly effective when supporting smaller and medium-sized firms. With its many scientific institutions Berlin offers extensive opportunities in this respect. Having a local institution in charge would bring the additional advantage that intensive company contacts--even though in specific areas only--would bring these institutions closer to real life.

Key Areas of BMFT Project Funding

00 Cross-sectional Activities

01 Basic Research in Natural Sciences

02 Humanization of the Work Life

03 Environmental Research and Technology

04 Biotechnology

05 Research and Technology to Secure Raw Materials

06 R&D Serving Health

07 Energy Research and Technologies

08 Information Technology

09 Aeronautical Research and Technology

10 Physics Technologies

11 Manufacturing Technology

12 Information and Documentation

13 Space Research and Technology

14 Transport and Traffic Technology

15 Oceanography and Ocean Technology

16 Construction Research and Technology

17 Safety Research and Technology

18 Polar Research

(1) Tabelle 1 (2) Projektförderung des BMFT in den Bundesländern 1975 bis 1983

- in v.H zur Gesamtförderung -

(3) Fach-programm	(4) Insge-samt	(5) Schleswig-Holstein	(6) Hamburg	(7) Nieder-sachsen	(8) Bremen	(9) Nordrhein-Westfalen	(10) Hessen	(11) Rheinland-Pfalz	(12) Baden-Württemberg	13) Bayern	(14) Saarland	(15) Berlin (W)
00	100,0	0,0	0,5	3,1	-	47,9	13,6	6,7	8,9	17,1	0,1	2,1
01	100,0	1,0	7,9	1,6	-	26,3	10,0	3,1	21,4	25,5	0,3	2,9
02	100,0	2,0	2,0	7,9	1,0	43,4	7,1	1,9	16,4	8,4	1,5	8,4
03	100,0	1,4	4,6	7,0	1,4	42,2	10,5	2,3	14,6	11,7	0,2	4,1
04	100,0	0,7	1,7	8,0	0,4	28,9	24,8	0,9	13,8	13,5	0,4	6,9
05	100,0	3,1	2,7	18,1	0,6	38,7	12,1	1,8	9,4	9,1	2,4	2,0
06	100,0	2,6	5,9	4,5	2,0	17,7	17,0	2,1	19,1	19,8	1,6	7,7
07	100,0	1,1	0,7	6,3	0,2	53,2	5,7	0,2	20,7	6,8	4,2	0,9
08	100,0	0,6	5,0	2,5	1,1	15,0	4,9	1,1	22,0	37,1	0,5	10,2
09	100,0	0,2	16,3	2,6	15,9	15,8	4,3	0,1	28,5	15,9	-	0,4
10	100,0	4,4	4,5	4,4	0,9	11,7	11,5	3,0	30,8	22,3	0,0	6,5
11	100,0	0,4	2,1	4,4	0,7	19,7	9,4	1,1	44,1	9,7	0,1	8,3
12	100,0	-	0,4	1,9	0,3	21,7	40,0	1,6	11,9	5,3	1,2	15,7
13	100,0	2,5	1,4	3,8	6,7	7,4	2,2	0,5	22,5	52,1	-	0,9
14	100,0	1,3	4,3	8,6	0,1	10,9	4,2	0,1	14,0	50,5	0,0	6,0
15	100,0	15,4	28,3	16,2	15,1	8,9	6,6	0,9	7,1	1,2	-	0,3
16	100,0	-	7,2	5,1	0,5	38,0	8,0	2,4	18,2	17,3	2,1	1,2
17	100,0	0,7	10,1	2,0	-	14,8	6,0	0,7	51,3	14,2	-	0,2
18	100,0	72,9	9,9	0,7	10,0	2,6	0,8	-	-	3,1	-	-
00-18	100,0	2,5	3,4	6,4	1,7	35,1	7,1	0,8	19,1	18,3	2,2	3,4
00-18 in (16) Mill. DM	24317	603	837	1548	401	8535	1719	120	4650	4459	536	830

Quellen: BMFT; DIW. (17)

1. Table 1
2. BMFT Project Funding in the Federal States from 1975 to 1983
3. Special Program
4. Total
5. Schleswig Holstein
6. Hamburg
7. Lower Saxony
8. Bremen
9. North Rhine-Westphalia
10. Hesse
11. Rhineland-Palatinate
12. Baden-Wurttemberg
13. Bavaria
14. Saarland
15. Berlin (W)
16. 00-18 in million marks
17. Sources: BMFT; DIW.

(1) Tabelle 2 (2) **Projektförderung des BMFT in Berlin (West)**

- in vH zur Gesamtförderung -

(3)

Fachprogramm	1975	1976	1977	1978	1979	1980	1981	1982	1983
00	1,7	0,7	1,0	1,6	2,4	2,0	2,5	1,9	2,9
01	1,5	1,1	0,9	0,3	0,9	1,4	2,5	6,1	8,4
02	1,1	1,8	4,8	11,1	12,3	13,5	9,8	6,4	5,2
03	4,2	5,6	6,1	4,6	3,5	2,4	3,7	4,0	5,7
04	7,0	5,5	4,2	7,4	4,8	9,3	12,9	6,9	5,3
05	0,8	2,2	3,2	3,2	2,3	1,7	1,9	1,4	1,6
06	6,1	9,8	7,1	9,0	8,9	7,8	6,7	6,8	7,0
07	0,6	0,4	0,5	0,9	1,5	1,1	1,4	0,6	0,7
08	4,4	6,3	7,1	7,2	12,8	19,1	21,2	9,9	10,5
09	-	-	-	-	0,3	0,5	0,6	0,6	0,4
10	0,5	3,2	4,8	8,4	9,6	10,3	9,2	7,6	3,0
11	3,3	8,3	6,5	6,6	9,1	11,6	10,2	8,4	6,8
12	12,4	22,1	11,4	9,7	13,3	21,8	22,2	14,3	15,5
13	0,1	0,4	0,8	0,9	1,0	1,3	0,8	0,8	1,1
14	2,4	4,4	2,4	3,7	7,7	7,3	8,9	4,9	7,5
15	-	-	0,1	0,1	0,5	0,4	0,3	0,5	0,8
16	-	-	-	-	2,4	4,2	2,4	0,5	-
17	-	-	-	-	-	-	0,4	0,1	1,0
18	-	-	-	-	-	-	-	-	-
00-18	2,0	2,9	2,7	3,2	4,6	4,6	4,7	2,4	3,0

Quellen: BMFT; DIW. (4)

1. Table 2
2. BMFT Project Funding in Berlin (West)
3. Special Program
4. Sources: BMFT; DIW.

(1)

Tabelle 3

(3)

Beiträge zum Bruttoinlandsprodukt

	(2) Bundesland	(4) der Bundesländer 1983	(5) des verarbeitenden Gewerbes[1] 1981
(6)	Schleswig-Holstein	3,6	2,7
(7)	Hamburg	4,7	3,4
(8)	Niedersachsen	10,0	9,3
(9)	Bremen	1,4	1,4
(10)	Nordrhein-Westfalen	26,9	27,9
(11)	Hessen	9,9	8,5
(12)	Rheinland-Pfalz	5,3	6,1
(13)	Baden-Württemberg	15,8	19,2
(14)	Bayern	17,3	16,5
(15)	Saarland	1,5	1,5
(16)	Berlin (West)	3,6	3,5
(17)	Bundesgebiet	100,0	100,0
(18)	1) Bruttowertschöpfung Quellen: Statistische Bundesämter, DIW.		

1. Table 3
2. Federal State
3. Contributions to the Gross Domestic Product
4. By the Federal States 1983
5. By Manufacturing 1981 (1)
6. Schleswig Holstein
7. Hamburg
8. Lower Saxony
9. Bremen
10. North Rhine-Westphalia
11. Hesse
12. Rhineland-Palatinate
13. Baden-Wurttemberg
14. Bavaria
15. Saarland
16. Berlin (West)
17. Federal Republic
18. (1) Gross value added
    Sources: Statistical Federal Offices, DIW.

(1) (2)

Tabelle 4 Projektförderung des BMFT in der Bundesrepublik Deutschland

- Struktur in vH -

(3) Fachprogramm	1975	1976	1977	1978	1979	1980	1981	1982	1983	1975-1983
00	1,1	1,1	1,0	1,2	1,2	2,2	1,9	1,7	1,9	1,5
01	2,4	3,1	2,8	2,6	2,5	2,7	2,5	2,0	2,6	2,5
02	1,4	2,1	2,4	3,2	3,1	3,2	3,2	2,7	2,8	2,8
03	2,1	2,1	1,9	2,4	4,4	3,4	3,6	2,6	2,9	2,9
04	1,2	1,4	1,6	1,3	1,3	1,1	1,1	1,2	1,6	1,3
05	2,3	3,1	3,1	3,7	6,2	7,1	6,6	4,7	5,5	5,0
06	3,2	3,7	3,4	3,0	2,7	3,0	2,7	2,1	2,6	2,8
07	44,4	39,2	43,0	42,2	40,4	41,5	43,2	53,6	50,1	45,0
08	21,7	21,5	18,0	15,6	13,5	8,9	8,4	7,3	7,9	12,4
09	0,4	1,1	1,5	1,5	1,6	2,0	2,2	1,9	2,0	1,6
10	1,3	1,4	1,4	1,3	1,1	1,0	1,0	0,8	0,9	1,1
11	0,5	1,2	1,6	1,8	1,4	1,4	1,2	1,1	1,1	1,2
12	1,3	1,2	1,3	1,7	1,6	1,5	1,0	0,8	0,6	1,2
13	6,4	6,7	5,6	6,1	5,4	5,8	5,7	6,1	6,8	6,1
14	6,4	6,2	7,3	7,9	9,6	9,1	8,9	7,2	7,4	7,9
15	3,6	4,2	3,1	3,7	3,0	3,1	3,0	1,8	2,4	2,9
16	0,2	0,6	0,7	0,5	0,5	0,5	0,4	0,4	0,4	0,5
17	0,1	0,1	0,3	0,3	0,2	0,2	0,2	0,2	0,2	0,2
18	-	-	-	0,0	0,3	2,3	3,2	1,8	0,3	1,1
00-18	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0
(4) 00-18 in Mill. DM	2046	1821	1966	2313	2887	2940	3119	3933	3293	24317

Quellen: BMFT; DIW. (5)

1. Table 4
2. BMFT Project Funding in the Federal Republic of Germany
   --by program in percent--
3. Special Program
4. 00-18 in million marks
5. Sources: BMFT; DIW.

(1) (2)

Tabelle 5 **Projektförderung des BMFT in den Bundesländern 1975 bis 1983**

- in vH zur Gesamtförderung im verarbeitenden Gewerbe -

(3) (4) (5) (6) (7) (8) (9) (10) (11) (12) (13) (14) (15)

Fach-programm	Insge-samt	Schleswig-Holstein	Hamburg	Nieder-sachsen	Bremen	Nordrhein-Westfalen	Hessen	Rheinland-Pfalz	Baden-Württemberg	Bayern	Saarland	Berlin (W)
00	100,0	-	14,1	-	-	32,2	24,9	-	-	12,4	-	16,4
01	100,0	-	-	2,3	-	20,6	-	8,5	-	68,6	-	-
02	100,0	4,1	1,1	13,6	1,6	27,6	7,8	4,4	18,4	15,8	0,7	4,9
03	100,0	0,9	5,2	4,0	1,5	41,9	16,0	3,7	8,2	16,3	-	2,3
04	100,0	-	1,0	1,7	-	31,8	36,3	1,5	11,9	7,2	-	8,6
05	100,0	0,5	2,4	17,4	0,8	41,6	14,5	2,6	6,0	10,8	3,3	0,1
06	100,0	9,0	8,5	0,9	2,8	7,6	19,5	1,1	20,8	25,0	0,1	4,7
07	100,0	1,5	0,3	4,1	0,3	54,2	6,4	0,2	24,3	8,3	-	0,4
08	100,0	0,5	5,9	1,5	0,7	10,6	3,3	0,6	24,9	49,9	-	2,1
09	100,0	0,2	20,3	-	20,3	0,9	4,4	0,1	36,3	17,5	-	-
10	100,0	5,8	5,8	3,4	0,9	8,3	12,7	3,7	32,6	23,3	-	3,5
11	100,0	0,7	3,4	4,8	1,3	13,6	14,5	1,6	43,7	11,6	-	4,8
12	100,0	-	-	-	-	19,5	49,9	0,9	1,1	11,9	-	16,7
13	100,0	2,7	1,6	0,2	11,7	1,3	0,3	-	15,2	67,0	-	0,0
14	100,0	1,1	1,6	8,0	0,0	10,6	4,0	0,1	12,9	60,2	0,0	1,5
15	100,0	41,4	12,5	8,9	12,1	7,9	7,8	2,4	3,8	3,2	-	-
16	100,0	-	-	2,5	2,9	50,2	6,0	4,3	6,1	19,8	8,2	-
17	100,0	1,0	14,9	1,5	-	0,5	1,6	-	65,1	15,4	-	-
18	100,0	100,0	-	-	-	-	-	-	-	-	-	-
00-18	100,0	3,4	2,4	4,6	1,8	34,6	6,7	0,6	21,1	23,5	0,2	1,1
00-18 in Mill. DM	13392	449	321	612	242	4630	903	81	2827	3153	28	147

Quellen: BMFT; DIW.

1. Table 5
2. BMFT Project Funding in the Federal States from 1975 to 1983 as a percentage of total funding for manufacturing
3. Special Program
4. Total
5. Schleswig Holstein
6. Hamburg
7. Lower Saxony
8. Bremen
9. North Rhine-Westphalia
10. Hesse
11. Rhineland-Palatinate
12. Baden-Wurttemberg
13. Bavaria
14. Saarland
15. Berlin (W)
16. 00-18 in million marks
17. Sources: BMFT; DIW.

(1)

Tabelle 6 (2) Projektförderung des BMFT in den Bundesländern 1975 bis 1983

- Förderung des verarbeitenden Gewerbes in vH zur jeweiligen Gesamtförderung -

(3) Fach-programm	(4) Insge-samt	(5) Schleswig-Holstein	(6) Hamburg	(7) Nieder-sachsen	(8) Bremen	(9) Nordrhein-Westfalen	(10) Hessen	(11) Rheinland-Pfalz	(12) Baden-Württemberg	(13) Bayern	(14) Saarland	(15) Berlin (W)
00	0,4	-	0,1	-	-	0,1	0,1	-	-	0,1	-	0,1
01	0,4	-	-	0,0	-	0,1	-	0,0	-	0,3	-	-
02	32,2	1,3	0,4	4,4	0,5	8,9	2,5	1,4	5,9	5,1	0,2	1,6
03	39,6	0,4	2,1	1,6	0,6	16,6	6,3	1,5	3,2	6,5	-	0,9
04	54,9	-	0,5	0,9	-	17,5	19,9	0,8	6,5	4,0	-	4,7
05	61,3	0,3	1,5	10,7	0,5	25,5	8,9	1,6	3,7	6,6	2,0	0,1
06	26,2	2,3	2,2	0,2	0,7	2,0	5,1	0,3	5,4	6,6	0,0	1,2
07	61,9	0,9	0,2	2,5	0,2	33,5	3,9	0,1	15,0	5,2	-	0,3
08	59,2	0,3	3,5	0,9	0,4	6,3	1,9	0,4	14,8	29,5	-	1,3
09	78,6	0,2	16,0	-	15,9	0,7	3,5	0,0	28,5	13,8	-	-
10	76,7	4,4	4,5	2,6	0,7	6,4	9,7	2,8	25,0	17,9	-	2,7
11	52,9	0,4	1,8	2,6	0,7	7,2	7,7	0,8	23,1	6,2	-	2,5
12	11,1	-	-	-	-	2,2	5,5	0,1	0,1	1,3	-	1,9
13	57,2	1,5	0,9	0,1	6,7	0,7	0,1	-	8,7	38,3	-	0,0
14	67,1	0,7	1,1	5,4	0,0	7,1	2,7	0,0	8,7	40,4	0,0	1,0
15	22,8	9,4	2,8	2,0	2,8	1,8	1,8	0,5	0,9	0,7	-	-
16	16,9	-	-	0,4	0,5	8,5	1,0	0,7	1,0	3,4	1,4	-
17	67,7	0,7	10,1	1,0	-	0,3	1,1	-	44,1	10,4	-	-
18	72,9	72,9	-	-	-	-	-	-	-	-	-	-
00-18	55,1	1,8	1,3	2,5	1,0	19,0	3,7	0,3	11,6	13,0	0,1	0,6

Quellen: BMFT; DIW. (16)

1. Table 6
2. BMFT Project Funding in the Federal States from 1975 to 1983
   funding for manufacturing as a percentage of total funding

3. Special Program
4. Total
5. Schleswig Holstein
6. Hamburg
7. Lower Saxony
8. Bremen
9. North Rhine-Westphalia
10. Hesse
11. Rhineland-Palatinate
12. Baden-Wurttemberg
13. Bavaria
14. Saarland
15. Berlin (W)
16. Sources: BMFT; DIW.

(1) (2)

Tabelle 7 **Beschäftigte im verarbeitenden Gewerbe in den Bundesländern[1)]**

- in vH zum Bundesgebiet -

	(3) Beschäftigte							
	1 - 19	20 - 49	50 - 99	100 - 199	200 - 499	500 - 999	1000 u.m.	Insgesamt
Schleswig-Holstein (4)	4,8	3,6	3,0	3,3	2,8	2,2	1,6	2,4
Hamburg (5)	2,2	2,0	1,8	1,5	2,2	2,3	2,4	2,2
Niedersachsen (6)	12,0	10,3	9,4	8,4	9,6	7,9	9,7	9,3
Bremen (7)	0,9	0,7	0,8	0,8	0,6	1,3	1,6	1,1
Nordrhein-Westfalen (8)	15,5	23,3	27,0	28,0	27,7	29,3	30,7	28,6
Hessen (9)	9,3	8,1	8,2	7,5	8,5	8,6	9,6	8,8
Rheinland-Pfalz (10)	5,9	6,8	6,1	5,4	5,2	4,7	4,8	5,2
Baden-Württemberg (11)	22,7	21,2	21,0	22,0	20,6	20,2	17,5	19,6
Bayern (12)	24,5	19,8	19,3	19,6	19,2	19,3	16,7	18,4
Saarland (13)	0,8	1,4	1,0	1,3	1,4	2,0	3,1	2,1
Berlin (West) (14)	1,4	2,8	2,4	2,2	2,2	2,2	2,3	2,3
Bundesgebiet (15)	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0

1) Ende September 1983, einschl. Bergbau (16)

Quellen: Statistisches Bundesamt, Wiesbaden; DIW.

1. Table 7
2. Persons Employed in Manufacturing in the Federal States (1)
   --as a percentage of the Federal Republic as a whole
3. Special Program
4. Schleswig Holstein
5. Hamburg
6. Lower Saxony
7. Bremen
8. North Rhine-Westphalia
9. Hesse
10. Rhineland-Palatinate
11. Baden-Wurttemberg
12. Bavaria
13. Saarland
14. Berlin (West)
15. Federal Republic
16. (1) End of September 1983, including mining

Sources: Federal Statistical Office; DIW

(1)
Tabelle 8

(2)
Zahl der Betriebe im verarbeitenden Gewerbe in den Bundesländern[1)]

- in vH zum Bundesgebiet -

	(3) Beschäftigte						(3a)	(3b)
	1 - 19	20 - 49	50 - 99	100 - 199	200 - 499	500 - 999	1000 u.m.	Insgesamt
Schleswig-Holstein (4)	4,8	3,7	3,1	3,3	2,7	2,3	2,2	3,5
Hamburg (5)	2,0	2,1	1,7	1,5	2,1	2,3	2,7	1,9
Niedersachsen (6)	11,0	10,5	9,4	8,5	9,7	8,0	8,7	9,9
Bremen (7)	0,8	0,7	0,8	0,8	0,7	1,3	1,6	0,8
Nordrhein-Westfalen (8)	14,6	23,0	26,8	27,8	27,6	28,9	30,7	24,0
Hessen (9)	9,5	8,1	8,2	7,6	8,4	8,7	9,4	8,3
Rheinland-Pfalz (10)	4,8	6,8	6,1	5,4	5,2	4,9	4,0	6,0
Baden-Württemberg (11)	20,5	21,3	21,1	21,9	20,9	20,4	17,8	21,1
Bayern (12)	29,9	19,7	19,3	19,6	19,2	19,1	17,3	20,9
Saarland (13)	0,9	1,4	1,0	1,3	1,4	1,9	3,0	1,3
Berlin (West) (14)	1,2	2,7	2,5	2,3	2,1	2,2	2,6	2,3
Bundesgebiet (15)	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0

1) Ende September 1983, einschl. Bergbau (16)
Quellen: Statistisches Bundesamt, Wiesbaden; DIW.

1. Table 8
2. Number of Manufacturing Companies in the Federal States (1)
   --as a percentage of the Federal Republic as a whole
3. Number of Employees
3a. 1,000 and more
3b. Total
4. Schleswig Holstein
5. Hamburg
6. Lower Saxony
7. Bremen
8. North Rhine-Westphalia
9. Hesse
10. Rhineland-Palatinate
11. Baden-Wurttemberg
12. Bavaria
13. Saarland
14. Berlin (West)
15. Federal Republic
16. (1) End of September 1983, including mining
    Sources: Federal Statistical Office; DIW.

(1)
Tabelle 9

(2)
Projektförderung des BMFT in Berlin (West)

- Struktur in vH -

(3) Fachprogramm	1975	1976	1977	1978	1979	1980	1981	1982	1983	1975-1983
00	0,9	0,3	0,4	0,6	0,6	0,9	1,0	1,3	1,9	0,9
01	1,8	1,1	0,9	0,2	0,5	0,8	1,3	5,1	7,4	2,1
02	0,7	1,3	4,3	11,2	8,2	9,4	6,7	7,1	5,0	6,9
03	4,3	4,0	4,3	3,4	3,3	1,8	2,9	4,3	5,5	3,5
04	4,0	2,7	2,5	3,1	1,4	2,2	3,1	3,5	2,9	2,7
05	1,0	2,4	3,7	3,7	3,1	2,7	2,7	2,8	3,0	2,8
06	9,6	12,4	8,9	8,4	5,2	5,1	3,9	6,0	6,1	6,3
07	13,3	5,8	7,8	11,1	13,1	10,0	13,1	12,3	11,2	11,3
08	47,1	46,1	47,3	35,1	37,4	36,9	37,9	29,4	27,9	36,8
09	-	-	-	-	0,1	0,2	0,3	0,4	0,3	0,2
10	0,3	1,5	2,5	3,3	2,4	2,4	1,9	2,5	0,9	2,1
11	0,9	3,3	3,7	3,7	2,7	3,4	2,5	3,6	2,5	3,0
12	8,1	8,9	5,5	5,2	4,5	7,2	4,5	4,7	3,2	5,4
13	0,3	0,8	1,6	1,8	1,1	1,7	1,0	2,0	2,6	1,5
14	7,7	9,4	6,5	9,1	15,8	14,5	16,8	14,5	18,9	14,0
15	-	-	0,1	0,1	0,3	0,3	0,2	0,4	0,6	0,3
16	-	-	-	-	0,3	0,5	0,2	0,1	-	0,2
17	-	-	-	-	-	-	0,0	0,0	0,1	0,0
18	-	-	-	-	-	-	-	-	-	-
00-18	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0
00-18 in Mill. DM (4)	41	53	53	74	134	135	147	96	97	830

Quellen: BMFT; DIW. (5)

1. Table 9
2. BMFT Project Funding in Berlin (West)
3. Special Program
4. 00-18 in million marks
5. Sources: BMFT; DIW.

FOOTNOTES

1. Institutions include scientific research institutes, government including universities.

2. Federal Research Report 1984, p 78.

3. Federal Research Report, p 69.

4. Federal Research Report, p 29.

5. Research and Development in Manufacturing in Berlin (West), p 118 and following pages.

6. Federal Research Report, p 29.

7. Application of Microelectronics, First Experience Report.

8. Research and Development in Manufacturing in Berlin (West), p 90.

9. Analysis of the Effect of Subsidies for Personnel in Research and Development.

10. Research and Development (R&D) in the Economy 1981, Research and Development in Manufacturing in Berlin (West).

BIBLIOGRAPHY

1. FEDERAL RESEARCH REPORT 1984, Printed Matter 10/1543.

2. "Analysis of the Effect of Subsidies for Personnel in Research and Development," Summary of an Expert Opinion of the Fraunhofer-Institute for Systems Technology and Innovation Research. CURRENT CONTRIBUTIONS TO THE ECONOMIC AND CORPORATE POLICY, No 64, 1984.

3. Echterhoff-Severitt, H., "Research and Development (R&D) in the 1981 Economy." In: MEMBERSHIP JOURNAL OF THE STIFTERVERBAND, issue 5, 1983.

4. Hornschild, K., "Research and Development in Manufacturing in Berlin (West)," CONTRIBUTIONS TO STRUCTURE RESEARCH OF THE DIW, 1983.

5. VDI-Technology Center, "Application of Microelectronics," FIRST EXPERIENCE REPORT, Berlin, 1983.

12381
CSO: 3698/424

SCIENTIFIC AND INDUSTRIAL POLICY

BMFT INDIRECT MEASURES, FUNDS TO AID RESEARCH

Leinfelden- Echterdingen EEE in German 5 Mar 85 p 44

[Text] The draft for the 1985 federal budget designates DM 7.25 billion for the BMFT [Federal Ministry for Research and Technology]. That is an increase of 2.9 percent compared to 1984, while the total budget increased by 1.2 percent. This budget is an important indicator of the Federal Government's research efforts since 70 percent of the civil research aid is being supported by the BMFT.

Indirect research support in the form of tax relief, bonuses, and subsidies is to be further increased (by 28.5 percent), while direct support for projects continues to drop. Therefore, the restructuring introduced in 1983 and 1984 is being continued. In particular, outlays for basic research and long-term basic research programs are increasing by 8.6 percent. For research concerning the evaluation of technology spin-offs, namely analyses of technological sectors to be developed and their possible effects on the environment, economy and society, 122 percent more is being spent. Research funds for technology-oriented start-ups are being increased by as much as 145.9 percent from DM 100 million to DM 325 million, and expansion of specialty information is being increased by 25.6 percent.

The 1985 budget earmarks, for the first time, funds for a new measure to support R & D personnel in business. Previous support through subsidies to underwrite personnel is being continued and expanded through an "aid to increase research personnel." The intent is to support mainly middle and small businesses with personnel-intensive research that intend to expand their research personnel through new appointments between 1 September 1984 and 31 December 1987. This aid includes 60 percent of gross wages and salaries of the newly employed personnel for a period of 15 months starting at the time of employment. The companies involved are those producers, including software businesses, with a maximum of 3,000 employees and a maximum turnover of DM 300 million.

Another support measure concerns the temporary personnel exchange between industry and science. During the course of this exchange, scientists from industry are supposed to gain practical knowledge for a fixed amount of time in research institutions such as the Max-Planck-Institutes, the Institutes of the Fraunhofer Society, or in university institutes in order to strengthen the

exchange of information and the transfer of technology between science and industry.

Those industrial enterprises are supported which can make available a maximum of five scientists who are dealing with research projects complementing the R & D activity of the business. The maximum length of support is 3 years. The scientists are supposed to work in key technologies, such as electronics, communication technology, information processing, robotics, sensor technology, biotechnology, physical technologies, materials research, composite materials, and production automation.

12521
CSO: 3698/450

TECHNOLOGY TRANSFER

FORMER FOREIGN MINISTER DECRIES U.S. 'BLACKMAIL' ON EXPORTS

AU101401 Vienna VOLKSSTIMME in German 10 May 85 p 2

[Text] Vienna--"Very quietly we had to pass humiliating legislation in the Nationalrat last December," said former Foreign Minister Erwin Lanc at a panel discussion of the association "Austria Physicians Against Nuclear War." He added that Austria's gesture of surrender to the U.S. technology boycott did not help the country at all--Austria was nevertheless put on the "grey list" of less "reliable" countries, that is, countries with loopholes to the East.

Lanc declared that the threat of a U.S. technology boycott and the Austrian bill obtained by blackmail were primarily an object lesson of the United States for Austria to punish it for its "insubordination" in international questions. According to Lanc, the results of the Austrian technology law is that now the U.S. companies themselves are doing the profitable business with the East, because these companies hardly ever have difficulties with their export licenses.

What such "humiliating legislation" could mean for Austria in the long run, in the former minister's opinion, is the following: "If we continue on the road on which we have now embarked, we will end up as serfs."

In this context Lanc drew attention to an aspect of the U.S. "Star Wars" program that had not been widely noted to date: Through its "Star Wars" project the United States could increase its technological headstart to a point where West Europe would be downgraded to the role of a technological handyman. In this case, West Europe would have to suffer the fate of being a sheer U.S. "satellite," Lanc said. In the opinion of the former foreign minister it is such fears that are behind France's vehement opposition to the U.S. "Star Wars" project.

CSO: 3698/468

TECHNOLOGY TRANSFER

SOVIETS INTERESTED IN ITALIAN TITANIUM PRODUCTION METHOD

Milan IL SOLE 24 ORE in Italian 6 Apr 85 p 8

[Text] The Marco Ginatta Electrochemical Corporation of Turin, a leading company in the development of innovative processes and electrochemical systems of non-ferrous metallurgy, has been invited to the Soviet Union to offer its technology. The meeting, organized by the Sytco Corporation of Milan representative in the USSR, took place in Moscow during the past few days.

The Soviet delegation was highly impressed by the GS process for the total recovery of the components of lead batteries. The system represents a substantial innovation in the traditional methods for the production of electrolytic lead from scrap batteries. While all present systems utilize pyrometallurgical [melting] processes with various degrees of sophistication, this process is exclusively electrochemical. Because all operations take place at room temperature, there are no highly-polluting smoke emissions, dust or slag created by the lead contents. The system recovers granulated polypropylene, which is reusable for the manufacture of the external casing of the batteries.

EMG [Marco Ginatta Electrochemical] showed the Soviet delegation other electrolytic processes for the recovery of non-ferrous metals from scrap such as tin cans or non-magnetic parts from scrap automobiles.

Great interest was shown in the primary metallurgical sector by the EMG process for the production of electrolytic titanium. Despite the fact that the USSR is the largest titanium producer in the world, with approximately 50,000 tons per year and is among the major experts in the mining of this metal that is fundamental to today's industry, the Soviet delegation was impressed by the degree of automation, the simplicity of the process and the quality of the product. The meeting constitutes an important milestone in gaining entrance into the Soviet and Comecon market by the Turin company.

9731
CSO: 3698/427

TECHNOLOGY TRANSFER

BRIEFS

ACRYLONITRILE PLANT IN EAST GERMANY--The Tecnimont (Montedison Group) will supply an agency of East Germeny, the Industrieanlagen-import of Berlin, a plant which will produce 60,000 tons of acrylonitrile (for plastic material fibers) per year. The total value of the unit exceeds 40 million dollars. The plant, which will be delivered ready to operate, will be built in Schwedt and will use Sohio technology. "Tecnimont will act in a main contractor capacity," Ruggero Guillet, president of the company, declared. "We will assume the responsiblity for the planning, building, and start-up of the new plant." The choice of the German customers was motivated by three reasons: "They have recognized that, worldwide, Tecnimont is one of the preferred contractors used by Sohio, holder of the technology license," Guillet explained. "The Italian engineering company has already built four similar plants. It has demonstrated that it is capable of building a better plant within a relatively short time and, finally, it has offered financial terms capable of beating the Japanese competition."
[Text] [Milan IL SOLE 24 ORE in Italian 2 Feb 85 p 9] 9731

CSO: 3698/427

END